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MYSTERIES AND MORALITIES.

BY EDWARD CLODD.

III.

A FEW isolated specimens and titles of lost plays excepted, the English Mystery Plays are usually, and hitherto correctly, described as comprised in three series—the Chester, the Coventry, and the Towneley, which last is sometimes called the Widkirk, or Wakefield.

The number is now increased to four by the recent publication of the York Plays, which fully equal in value, and perhaps surpass in antiquity, the foregoing collections. The existence of this important collection was unknown even to Mr. Collier, who, in the revised edition of his "History of Dramatic Poetry," published in 1879, speaks of the *Skryvener's Play* on the incredulity of St. Thomas, as "the sole relic of a series of religious dramas formerly exhibited at York."*

The York series is printed from a manuscript in the possession of Lord Ashburnham, in the editing of which Miss Toulmin Smith has brought together a mass of interesting detail from the municipal records of York, throwing much light on the history of the plays.† The original versions of these several series have, in their passage from copyist to copyist, and in their adaptation to suit varying local tastes, undergone such alteration that the exact date of their composition cannot be determined. The *Chester* collection,‡ containing 25 plays, has long been regarded as the oldest, its composition being referred by local antiquaries to the middle of the thirteenth century, when, according to tradition, the earliest performances took place under the mayoralty of Sir John Arnway. His name appears in the first verse of the Banes "reade before the beginninge of the playes."

> "Reverende lordes and ladyes all,
> That at this tyme here assembled bee,
> By this messauge understande you shall
> That some tymes there was mayor of this citie
> Sir John Arnway, Knighte, who moste worthilye
> Contented hymselfe to sett out in playe
> The devise of one Done Rondall, moonke of Chester Abay."

The evidence in support of so early a date is, however, slender, and the manuscript from which the foregoing lines are quoted was transcribed three and a half centuries later, namely, in 1600. Its learned editor, Mr. Wright, is of opinion, from the phraseology and form of words which may frequently be discovered in the blunders of the modern scribes, that the original manuscript—from which it and another copy dated 1607 were made—was of the earlier part of the fifteenth or the end of the fourteenth century."*

The *Coventry* series,† comprising 42 plays, is contained in a quarto volume preserved in the Cottonian collection of manuscripts in the British Museum. The date of this relic, 1468, is ascertained from its fortunate insertion on one of the folios by the transcriber, presumably a member of the Order of Grey Friars of Coventry, under whom the plays were first produced.

The *Towneley* collection,‡ containing 32 plays, is so called from its possession by the Towneley family, at whose hall in Lancashire it was preserved until the recent sale of their library. The plays, written on folio parchment, and ornamented with elaborate initial letters, were, in the opinion of their editors, the composition of the friars of an abbey formerly situated at Widkirk, or Woodkirk, near Wakefield. The performances probably took place at the fairs held outside the abbey-gates, until their transference, in the lapse of time, to Wakefield, where the guilds played them for the recreation of the burgesses. They are written in a Northern dialect, but little modernised, akin to that of the York series, sprinkled with words of Scandinavian origin, and are supposed to date from the close of the fifteenth century, a few years later than the Coventry collection.

The manuscript of the *York* series, comprising 48 plays, performed with the sanction and authority of the corporation, once belonged to that body and was prepared after "A.D. 1415, with the intention of entering all the plays in their due order, with the names of the crafts then performing them." The experts at the British Museum consider the handwriting to date between 1430-1450, and the editor, arguing from the style and metre, and especially from references at the end of the fourteenth century to the plays as of "old time," places their composition in the middle of that century, not long after the appearance of the *Cursor Mundi*,§ with the subject and general arrangement of which poem they have much in common. If this be so, there is strong argument for regarding the York series as the oldest of the four, certainly as preceding the Towneley, five of the plays in which are almost literal transcripts of corresponding plays in the York collection. It may be that both sets are variants of lost originals.

* Vol. II. p. 71.

† *York Mystery Plays*: the plays performed by the Crafts or Mysteries of York on the day of Corpus Christi, in the fourteenth, fifteenth, and sixteenth centuries. Edited by Lucy Toulmin Smith. (Oxford: Clarendon Press. 1885.)

‡ *The Chester Plays*. Edited by Thomas Wright, for the Shakspeare Society. Two Vols. 1843 and 1847.

* Introduction, p. xvi.

† *Ludus Coventriæ*, edited by J. O. Halliwell-Phillips for the Shakspeare Society. 1841.

‡ The *Towneley Mysteries*, edited by Dr. Lingard and others for the Surtees Society, 1836. The manuscript is now in the possession of Mr. Quaritch.

§ *The Cursur o the World*: a Northumbrian poem of the XIVth century. Edited by the Rev. Richd. Morris for the Early English Text Society. 1874–1878.

XUM

The feature common to the four collections is their combination of the leading events narrated in the Bible into a consecutive whole, but with considerable difference both in the subordinate parts and in the proportion of plays based on legends outside the canonical books of Scripture, *e.g.*, the popular mediæval legend of the Fall of Lucifer, which has great prominence given it in the *Cursor*, in the poems of Cædmon and other early writers, and of which Milton makes such effective use in *Paradise Lost*, is the subject of a Mystery in the York and Chester Series, but is absent from the Coventry and Towneley. The Coventry Series has no plays founded on the apocyrphal books of the Old Testament, but several founded on those of the New Testament, as the Jealousy of Joseph, the Trial of Mary and Joseph, and others, whilst in the Chester Series, only one play, based on the legend of Christ's descent into hell (which, however, may have vague reference in the Epistle of Peter),* has its source in the apocryphal books. A comparative table of the four collections which is given in the Introduction to the York Plays enables us to see at a glance what plays are common to all.†

It is obvious that when the plays were popularised by their translation from Latin or French into a tongue "understanded of the people," a good many extraneous elements were introduced, and those chiefly of the mirth-kindling sort, according to the dramatic skill and humour of the transcribing adapter, and to the public appetite, whether of boors or townsfolk, to be whetted. Thus the Chester Banes tell how Done Rondall, "moonke of the Abay,"

> "in scriptures well seene,
> In storyes travilled with the beste sorte,
> In pagentes set fourth apparently to all eyne
> The Olde and Newe testament, with livelye comforth,
> Interminglinge therewith, onely to make sporte,
> Some thinges not warranted by any writt,‡
> Which to gladd the hearers he woulde men to take yt"

The qualities attached to certain characters became more extravagant as the players depended more for success on fun and burlesque, and as the audiences demanded some new sensation or excitement to mirth, in the main of harmless sort. For even the grossness which is no uncommon feature of the plays, notably in the Towneley, was due not so much to low moral tone in actors and spectators, as to lack of refinement and the unstudied plainness which calls a spade a spade. Moreover, the plays are often obviously founded on French originals, in which there was no lack of laughter-compelling scenes. In the early miracle-play of S. Nicholas, the vulgar conversation of pot-house gamblers is a mirth-provoking incident; in the Towneley mysteries, Cain brawls, and bullies his hind like a coarse and vulgar Yorkshire farmer; in both the Chester and Towneley series Noah's wife is a termagant, and the quarrels between the two are full of comic dialogue; in the "Shepherds," the most popular play of all, the rustic realism is prominent in amusing, and, as quotations will presently show, in farcical form, while its introduction is of value as illustrating the habits, language, and food of the rural classes in the fourteenth and fifteenth centuries; in the York series, Judas is ridiculed by a porter; Pilate outwits a squire who sells a plot of land for thirty pieces of silver paid to the traitor, and gives up the deeds without securing the money; in many of the pageants where the devil is a character, he appears only to be laughed at; while hell-mouth, as will be seen hereafter, was a great clerical hit. The anachronisms and classical allusions are amusing, as when Noah's wife swears by Christ, the Virgin Mary, and St. John; Pharaoh and Cæsar Augustus by "Mahoune," and Balak by Mars; when Herod asks his council what they find "in Vyrgyll, in Homere," regarding the birth of Christ, and promises to make one of the counsellors Pope; when the Sybil prophesies before Octavian of Jesus and the Judgment, and when the watching shepherds Harvey, Tudd, and Trowle drink "Halton ale," and quote Virgil as among the prophets. But nowhere, apparently, do the characters of Jesus and his mother appear shorn of dignity or of qualities for reverence;* while the woman is never wholly lost in the glory of the Virgin Mother, as when, in the Flight into Egypt, she clings to the protection of Joseph. In Abraham's sacrifice the struggle between fatherly love and submission to the decree of heaven is treated by the dramatist with combined tenderness and dignity. In the Coventry variant when Abraham is dumb with grief, Isaac says:

> Fayre fadyr, ye go ryght stylle,
> I pray you, fadyr, speke unto me.

Touches, &c., of current life and usage here and there stand out amid the ancient story; the carpenter's tools and measurements used by Noah, as well as those employed at the Crucifixion; the bitter cold weather at the Nativity, telling of a truly northern Christmas; the quaint offerings of the shepherds; the ruin of the poor by murrain in the account of the ten plagues; the drinking between Pilate and his wife; the sleeping of Herod; and the excellent representation of a heavy manual job by a set of rough workmen in the Crucifixion. Illustrative, too, of English custom and forms of justice are the borrowing of the town beast; Judas offering himself as bondman in his remorse; the mortgage of a property (raising money by wed-set); and the trial scenes in certain plays, in which Pilate "in Parlament playne" vindicates the course of law, and puts down the eager malice of the accuser Caiaphas and the sharp pursuer Annas.†

The most ancient extant English Mystery play‡ is based on the legend of the descent of Christ into hell to liberate Adam, Eve, John Baptist, and the Prophets, as narrated in the apocryphal gospel of Nicodemus.§ It probably formed one of a series no longer in existence, and is, in the judgment of Mr. Collier and other authorities, not later than the earlier part of the reign of Edward III. An analysis of this popular play will be more in place when treating of the general contents of

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* Ch. iii. 19. "By which also he went and preached unto the spirits in prison."

† Pp. lxii., lxiii.

‡ In the Prologue to the *Coventry Mysteries* the vexillator says:

> "for we purpose us pertly stylle in this prese (crowd)
> the pepyl to plese with pleys ful glad,"

to which Mr. Halliwell-Phillips adds this quaint analysis of the different kinds of plays and players from the *Harleian MS.* 221, fol. 129:—

"Pley, ludus; pley, or somyr game, spectaculum; pley that begynnythe with myrthe and endythe with sorowe, tragedia; pley that begynnythe with sorrow and endythe with myrthe, comedia; playere lusor; playere that alwey will pley, ludibundus."

* In Archdeacon Roger's records of the Chester Plays (*Harleian MSS.*, 1944) reference is made to the custom of gilding the face of the actor who played God, and to a request that as this gilding "disfigured the man," the omission of the Deity might be pardoned, and that the audience would not expect God "to appear in shape or person," but in "a cloudy covering."

† *York Mystery Plays*, Introduction, lvii.

‡ *Harleian MSS.* No. 2,253. Brit. Mus. Printed in Mr. Collier's *Five Miracle Plays*.

§ Cf. Cowper's *Apocryphal Gospels*, pp. 303-311.

the four collections, in each of which it occurs in longer or shorter form.*

Among the few other detached plays, there are, in addition to the *Skryvener's* play of S. Thomas mentioned above, three preserved among the Digby manuscripts in the Bodleian Library, having for their subjects, with addition of much irrelevant matter, the story of the Conversion of S. Paul, of Mary Magdalene, and the Slaughter of the Innocents. One devil named Mercury enters with thunder and "a fyeryng, comyng in hast, cryeing and rorying," and informs "Belzal," with dismay, of the Apostle's conversion, expressing his opinion that "the devyl's law will now be clene downe layd." The two agree to stir up the Jewish Bishops to interfere in the matter, and then "vanyse away with a fyre flame and a tempest." Mary Magdalene lives in a castle which the Devil, with the aid of the Seven Deadly Sins, besieges, and the history of Mary's fall follows. The handwriting of this manuscript is of the reign of Henry VII.

Among the lost plays, Miss Toulmin Smith† refers to one, perhaps belonging to a series called the "Play of the Lord's Prayer," of which Wyclif, who died in 1384, speaks in his advocacy of the translation of the Bible as the "paternoster in English tongue, as men seyen in the play of York." Is would appear to have been more of the Morality type, certain qualities being personified, and was so popular that a guild of men and women was established for the purpose of keeping it up. Another series of lost plays, based on the *Creed*, was performed in York every tenth year by the guild of Corpus Christi, and there was also, in the same city, the universally-acted play of S. George, which elsewhere, as at Windsor, was exhibited more as a spectacular pageant or pantomime (*i.e.* in dumb show) than as a drama, the saint "ridyng and fightyng with the dragon, with his spere in his hand."

NOTES ON MAPPING.

BY RICHARD A. PROCTOR.

(*Continued from p.* 8.)

THE EQUIDISTANT PROJECTION.

THE equal surface projection dealt with in my last paper on mapping, though useful for special purposes, is of course not suited for general use in atlases. Equality of area can only be obtained at the expense of considerable distortion, even when a portion only of the surface of a globe is presented: when a hemisphere is shown, the distortion is still greater; and it becomes excessive when the whole globe is presented,—though this, of course, must be the same with all methods of projection.

I have by no means done with the subject of equal-surface projection. I shall have hereafter, a good deal more to say, even about the special method of equal-surface projection which I dealt with in my last paper. There are other methods of presenting portions of the globe, or the whole globe, correctly as regards area,—as for instance the extension of Flamstead's method, and the cylindrical equal-surface projection, which I devised in 1867.* These methods are described and illustrated in my "Essays on Astronomy," but as that work is nearly out of print, and no new edition will be issued, I shall shortly take occasion to describe the methods in these pages.

For the present, I turn from the equal-surface projection, to the equidistant projection, which I take to be on the whole, by far the best projection for all maps of large portions of a globe's surface, and to be theoretically the best also for maps of small portions, though practically, the conical projection, owing to the much greater ease with which it can be drawn, will probably be always preferred for showing small areas,—as countries like England, France, Spain, on the earth, and constellations on the globe.

In reality, neither the equal-surface nor the equidistant methods are projections at all. For, a projection of outlines on a spherical or other curved surface signifies the curve in which straight lines drawn from a fixed point to all points on such outlines, meet some other surface, plane or curved. A projection in mapping is always made on a plane surface. The Gnomonic, Stereographic, and Orthographic projections, are all properly called projections. The equal-surface method described in my last may be conceived as a sort of double projection: for, if the sphere be supposed to rest in a hemisphere of twice its radius, and from the highest point of the sphere, all outlines on the sphere are projected upon the hemisphere: and then from a point at an infinite distance vertically above the hemisphere, the outlines so obtained are projected upon a horizontal plane, the projection thus formed will be the central equal-surface projection described in my last. The so-called equidistant projection is not however a projection even in this sort; but purely a method of construction.

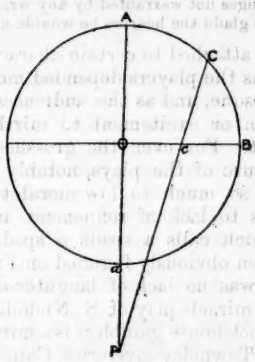


Fig. 1.

It is true a projection *called* the equidistant and sometimes the *globular* was suggested long ago, by the French mathematician Lahire, in which a point P (Fig. 1) was taken at such a distance on A O *a*, a diameter of the sphere, produced, that a straight line P C, to C the bisection of the quadrant A C B, bisected A B in *c*. But this method does not project all equal arcs along A B into equal lines along O B. Nor has it any practical value whatever. I doubt if even Lahire himself ever thought it worth while to construct a chart on this plan. Delambre suggested the true equidistant construction, which may be defined as *a construction in which all points*

* *York Mysteries*, No. 37, "Harrowing of Hell." *Chester Mysteries*, No. 18, "Harrowing of Hell." *Coventry Mysteries*, No. 33, "The Descent into Hell." *Towneley Mysteries*, No. 25, "Extractio animarum ab inferno." Cf. also *Cursor Mundi*, ll. 17,849–18,450.

† *York Mysteries*, xxix., and see also Appx. II., pp. lxiv.-lxviii. for complete list, as far as known, of places and plays in Great Britain and Ireland.

* It was subsequently re-invented by Professor P. Smyth, and employed to show that the Great Pyramid is the centre of the land-surface of the earth—which is absurd; to such base uses may the best laid plans of men (and mice) be brought!

are represented in their true direction from the centre, and at their true distance as measured on the globe. The meridians and parallels in the maps of hemispheres given in most atlases are not on the true equi-distant construction, though they approximate to it fairly enough. They are obtained by dividing two diameters E D E′ and P O P′ of the circle P E P, Fig. 2, crossing at right angles into eighteen equal parts in *a b c* &c. each quadrant P E, P E′, &c. into which they divide the circle into nine equal arcs in A, B, C, &c. Circular arcs P *a p*′, P *b* P′ &c., give the meridians and circular arcs. A *t* A′, B *s* B′, &c., give the parallels of latitude. To show that this construction differs appreciably from the true equidistant construction, we need only notice that in the latter the parallels corresponding to A *t* A′, B *s* B′, &c., meet the circumference P E P′ E′ at right angles, which is obviously far from being the case with the circular arcs A *t* A′, B *s* B′, &c.

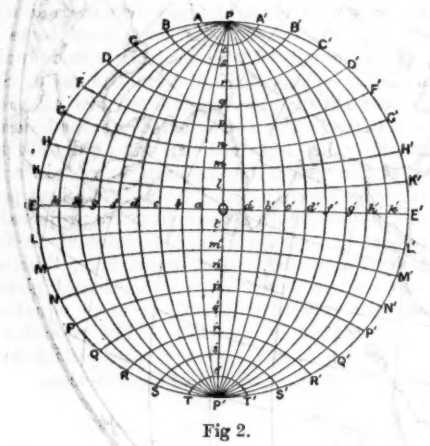


Fig 2.

Turning to the true equidistant construction :—

It is easy to determine the rate at which scale and shape vary in this construction. Distances measured from the centre, or along any part of a radial line, are by the very nature of the projection correct. Thus if A (Fig. 3) is the centre of the globular surface to be presented, and A K B an arc on the sphere, A K B is shown in the projection as *a k b* (Fig. 4), a straight line, such that

$$a\,b = \text{A B};\ a\,k = \text{A K};\ k\,b = \text{K B}.$$

Hence circles on the sphere, having A as its pole (B D E, K L F, Fig. 3, represent quarters of such circles) are

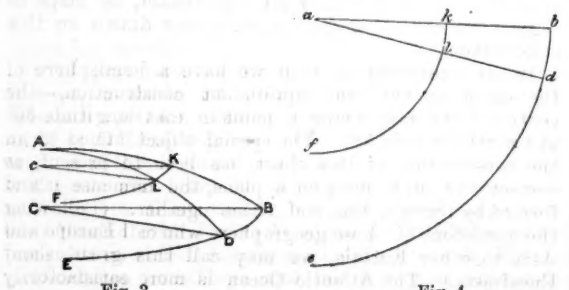


Fig. 3.

Fig. 4.

represented as circles *b d e*, *k l f*, in the construction. But the radii of the circles B D E, K L F, on the sphere are B C and K *c*, the *sines of the arcs* A B and A K, whereas the corresponding circles in the construction have radii *a b* and *a k* equal to the *arcs* A B and A K. Hence we see that while the scale does not differ radially in the equidistant construction from the scale on the globe itself, it is larger transversely to the radius, in the same degree that the *arc* distance on the globe is larger than the *sine of the arc*.

Of course this is a defect; and if it were possible by any method of construction to get rid of all defects, in the representation of part of a globe upon a plane surface, then we should have to reject the equidistant construction on account of this particular fault. But as this is not possible, we have to inquire whether any other construction is on the whole more suitable, or characterised by smaller defects.

Several authorities, from whom one does not care to differ, consider that the equidistant projection should not be used—as it always is—for maps of hemispheres in our atlases, because the projection thus gives different scale-variations in different directions, from no variations at all along a radius, to an increase in the proportion of 15,708 to 10,000 transversely to the radius at the outside of each hemisphere. Professors Hughes and Nichol, and Sir George Airy, have given their verdict in favour of the stereographic projection for the purpose of showing hemispheres. I imagine, however, that they have none of them drawn charts of more than one pair of hemispheres on the stereographic projection. If they had, they would hardly assert, as they do, that the continents are represented of their true shape in this projection; for, Africa or South America, in a stereographic projection, with the south pole as centre presents a very different shape from the same continent on a projection having a point on the equator as centre. It is true that, in the stereographic projection, the scale at any point is greater in the same degree radially and at any angle whatsoever to the radius, than the scale at the centre; and if we were in the habit of measuring short distances on charts of hemispheres, this would be an important advantage. But as we never do this, and as large distances are affected in no such uniform manner, the stereoscopic projection has no advantage over the equidistant in regard to uniformity of scale-variation; while as regards amount of scale-variation it is altogether inferior, the increase at the border of a hemisphere being as 2 to 1, in the stereographic (radially and transversely both) as compared with 1 to 1 radially and 1·57 to 1 transversely, in the equidistant construction.

As to change in area-scale, a much more important point in maps of large portions of the globe, the stereographic projection compares still worse with the equidistant; for while the areas at the border of a hemisphere on the equidistant projection are only larger than those at the centre, as 157 is larger than 100, or not much more than as $1\frac{1}{2}$ to 1, they are four times as large in the stereographic projection.

Thus the equidistant construction is much better than the stereographic for maps of hemispheres in ordinary atlases. For sailors' charts, as I shall hereafter show, the stereographic projection is the best of all, and, except for rhumb-sailing, ought long since to have replaced Mercator's. But for atlases, in which the maps of hemispheres are intended to give a good general idea of the positions and (as far as possible) the relative dimensions of different parts of the earth, the equidistant projection is much the best.

The great fault of the maps of hemispheres in our atlases, is that only a pair is given, and this pair always the same. The learner always sees Africa, Canada, and Greenland, Siberia, Australia, and New Zealand distorted

Map of Hemisphere having centre in E. long. 30°, N. lat. 38°, on the true equidistant construction.

and enlarged *in the same way* and naturally falls into the mistake of supposing that these false shapes and sizes are correct. Were a different pair of hemispheres introduced, at any rate in the larger atlases,—as for instance a northern and a southern map, two maps having Greenwich and its antipodes as centres—the erroneous ideas thus conveyed would be to some degree corrected.

The chief value of the equidistant construction consists, in my opinion, in its suitability for maps of large portions of the globe, celestial or terrestrial, not in its use for hemispheres. It is more useful for these than any other projection; but maps of hemispheres, at least as parts of an atlas, are not nearly so important as maps of continents or of countries.

I illustrate first, however, the use of the equidistant projection for maps of hemispheres; as this point naturally comes first under consideration, this being the use for which the construction was originally suggested. I believe, indeed, that until the publication of my "Constellation Seasons," my "Library Star Atlas," and my "School Star Atlas," which, (like my "Stars in their Seasons," and the maps of my "First Star Lessons," now appearing in these pages) are equidistant, no maps of regions less than a hemisphere were ever drawn on this construction.

In the accompanying map we have a hemisphere of the earth on the true equidistant construction,—the centre of the map being a point in east longitude 30° and north latitude 38°. The special object aimed at in the construction of this chart, has been to present, as correctly as can be done on a plane, the immense island formed by Europe, Asia, and Africa together. (Following the precedent of those geographers who call Europe and Asia together Eurasia, we may call this great island Eurafrasia.) The Atlantic Ocean is more satisfactorily presented in this map than in any given in our atlases. But a point in longitude 40° W., or 70° further west than the centre of our map, is better suited to show the Atlantic. The student will find it a pleasant and instructive exercise to draw such a chart, using the same

meridian-lines and parallels as in the accompanying map, but taking the central meridian to represent the meridian 40° west of Greenwich.

(To be continued.)

PHOTOGRAPHY AND MEDICAL JURISPRUDENCE.

By WILLIAM MATHEWS.

II.—THE GALTON COMPOSITES IN THEIR RELATION TO THE DETERMINATION OF IDENTITY.

THE achievement of consolidating into a single typical photograph the portraits of six or seven separate sitters has naturally awakened some curiosity. Other and even more remarkable operations may be expected to follow. Little by little, the field of inquiry will extend itself. In the natural course of evolution, possibilities will loom into view that, thus far, are not within the scope and purpose of the experimentalists.

One of the more inevitable of these approaching developments falls so entirely within the pathway of procedure that its investigation cannot be much longer postponed. In this very novel portraiture of the "composite order" there are some attendant phenomena that are of a nature at once to challenge observation and to lead in the direction indicated.

At the very threshold it becomes apparent that due attention has not been yet conferred upon the conjointure—certainly under less exacting conditions—of an arranged series of the photographs of the self-same sitter. Of such photographs, it is obvious that their superstructure should be constituted of portraits taken at definite and well-separated epochs.

The changes which ensue from youth to maturity and from maturity to decadence are clearly amenable to certain physiological limitations. These, by this time, photography might have definitively elucidated. The "Seven Ages" of the dramatist display, we may rest assured, various "points in common" which the photographer, as well as the psychologist, might now-a-day detect and investigate. That the "boy is father to the man" is admitted. But what a portrait will that be in which the boy, the lover, the soldier, and the justice are conjoined into one harmonious photograph! That will be a "modern instance" worthy of the age!

In the "Galton composites" it has been noted that, in those that are the most successful, the final outcome is in some particulars more effective and life-like than are the separate portraits of the members of the group. If the question be here mooted, tentatively, Whence comes this curious and unexpected consequence? it is hoped that it may not be deemed waste effort.

It should be recognised that the picture assumes in some degree the aspect of being in relief. The appearance might be fitly called "medalesque." How happens this? In reply, it may be pointed out that, in a kindred branch of art—in all such engravings as are designed to assume the appearance of medallion-work or *basso-rilievo*, the artist adopts a given expedient which is readily appreciable. Along the margins, between the half-tones and the darker outlines of the engraved work, there is always interposed a zone of absolute white, representative of the play of light upon the illuminated edges of the design.

Similarly, it will always occur that in the case of superposed portraits, and, *à fortiori*, in those in which the outlines are the more perfectly conformable, a broken zone of lighter tinge will skirt the outer shadows, just where the "points in common" the most manifestly approximate.

Here, then, we obtain a glimpse of the conditions under which this effect shall become the most obviously pronounced in its degree. And, in this connection, it must be regarded as already experimentally ascertained that, in the instance of an individual who has reached maturity, the typical form of the face will thenceforward be maintained without manifest or appreciable departure.* It is clear that, under such circumstances, the fiducial lines remain in unison, and that there will arise no difficulties in effecting the absolute super-imposition of the portraits.

Meantime, let it be regarded as inevitable, that in the interval between two or more sittings the sitter has become either more plump or more attenuated. Whichever event has happened, the super-imposition will be attended with an identical issue. Interposed between the half-tones of the facial areas and the exterior marginal shadows there will appear narrow belts of lighter tinge, by which the coupled images will be differentiated.

From this vantage-ground, therefore, we betoken the assured attainment of a novel and artistic result in photographic portraiture. This it is for the ingenious to develop. More to our present purpose is the consideration that medical jurisprudence may find here the adjunct of a new and undubitable test of personal identification. Here, if anywhere, we may catch sight of "that function which science asks of photography, and which medical jurisprudence is entitled to ask of both."

Need it be added that this presumed *terra incognita* has been already practically, if but partially, explored, and that it now awaits only that formal annexation to the ever-extending realms of science which, sooner or later, must inevitably take effect.

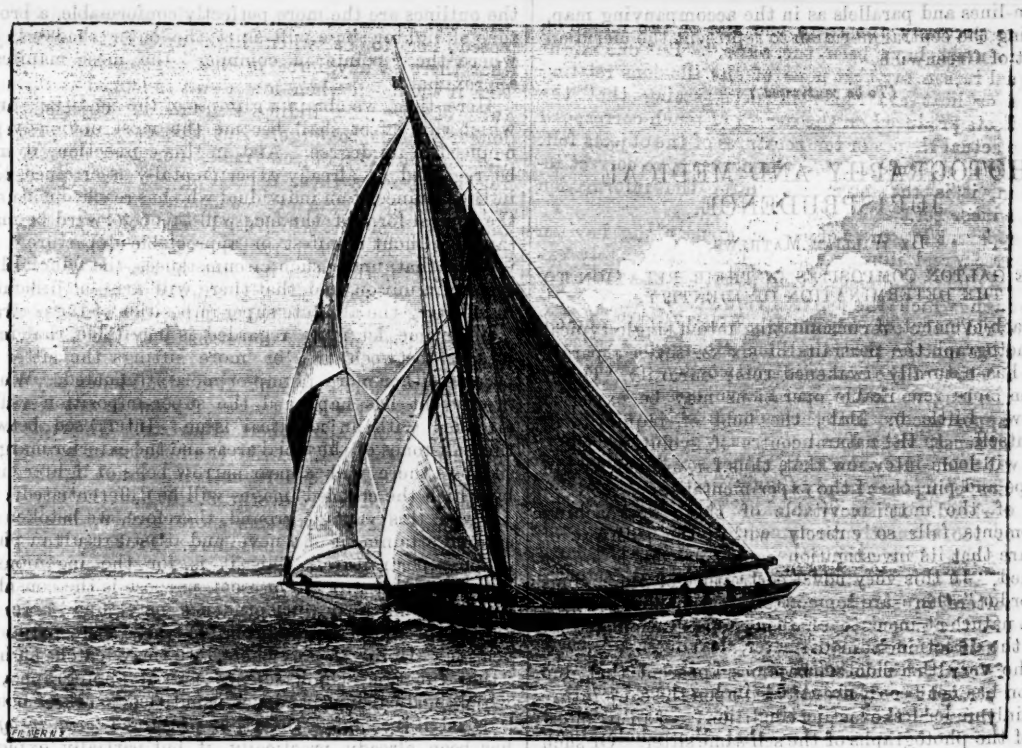
THE "GENESTA."

THE greatest sporting event on the water this year will be the international yacht race for the *America's* cup, held under the auspices of the New York Yacht Club. Great interest is being manifested by the yachtsmen and others throughout the whole country in the coming contest, while the patriotic pride of many wealthy men in the race has been aroused to such a pitch that they have ordered several new and costly yachts to be built for the protection of the cup. Even General Butler has dropped politics (and law) long enough to say that he wants to enter the ancient *America* in the race. England will send two very fast yachts, with the hope that one of them will walk away with the prize. These are the cutters *Genesta* and *Galatea*. The former is the favourite, and seems to be most feared by the Yankee yachtsmen.

It is understood that the match is to be three races, best two to win—one a triangle 40 miles, one over the New York Club course, and the third, if necessary, 20 miles and return, starting from Sandy Hook.

The *Genesta* was built by Messrs. Henderson Bros., at Partick-on-the-Clyde. She is 90 ft. over all, 81 ft. on the water-line, 15 ft. beam, 11¾ ft. depth of hold, and 13½ ft. draught. Although originally she had only 60 tons of lead outside, she now carries 70 tons of lead on her keel.

* In the conjointure of a photograph of Mr. Gladstone, of thirty years *ante*, with one of the present date, this effect is strikingly illustrated. In such case each portrait receives its due modicum of exposure.



The English Cutter *Genesta*.

She has also been recently coppered and fitted with new and heavier spars. Keelson stringers, frames, and strengthening plates are all of steel, while the planking is teak and elm.

With great accommodations beneath, the cutter's fittings are plain but substantial. The deck fittings present several novelties. The bowsprit comes over the steamhead in the centre of the yacht, with more than the usual difficulties in reefing it. To obviate this difficulty, one of the checks of the steel bits is hinged. This device permits of the bowsprit heel being swung round clear of the scuttle and the capstan, and run aft alongside the mast. The fore scuttle, oval in form, is a steel tube, round which the wire-fall of the bobstay tackle is coiled in easier turns than it would be belayed in the ordinary way. Just before the mast is a second scuttle, which accommodates the steward, and also the crew, on racing days. Behind the mast is a third scuttle, down which canvas can be lowered into the sail-room under the cabin sole.

The *Genesta* will be without any provisions for screening the weather spray besides a racing cabin. The *Genesta* has a fine saloon, fitted up lightly and elegantly, a ladies' cabin aft, and spacious accommodations for the crew, steward, and captain. The whole length of the yacht has been utilised, and the space obtained is remarkable. The *Genesta* is to be in charge of C. Carter, who is well known on the Clyde as a clever yacht sailor. She is owned by Sir Richard Sutton. Our engraving is taken from an instantaneous photograph, representing the *Genesta* ploughing through the water at full speed; it clearly shows the wave-line, and indicates the ease with which she parts the water. All through the yachting season last year this boat met the best of the British fleets, and, although not always a winner, she proved herself to be, without doubt, the best "all round" boat in the kingdom.—*Scientific American.*

ILLUSIONS OF THE SENSES.

By Richard A. Proctor.

(*Continued from p. 63.*)

IT is, however, the sense of sight which has most thoroughly deceived the student of science, almost justifying Professor Le Conte's statement that no evidence is more misleading and fallacious than the evidence of the senses. So far from seeing being believing, one recognises that often we see an object wrongly tinted, wrongly illuminated, wrongly shaped, besides that fault of wrong apparent size which we might expect to recognise in the case of a sense like sight (which gives no direct evidence as to distance).

Taking this last defect of sight-evidence first, we note that the eyesight cannot really be said to delude us when it seems to tell us that—for example—the moon is as large as the sun. All that sight really tells us is that the sun and the moon occupy fields of view of the same apparent size. This, of course, is correct information as far as it goes, and the sense of sight cannot go further. But the sense of sight conveys false ideas to the mind sometimes even about apparent size.

Perhaps the most remarkable case of the kind—at any rate the most familiar—is the apparent increase of the sun and moon in size as they approach the horizon. Singularly enough, Professor Le Conte does not regard this as an optical illusion; "the visual angle being in

both cases precisely the same, the size of the image on the retina must have been the same." But one might with equal reason say that none of the illusions relating to touch or heat are really illusions, seeing that the actual effects produced on the nerves of touch correspond with the actual shapes or temperatures of the objects felt. In every case of sense illusion the nerves give correct information, it is the interpretation of the information which is incorrect.

The apparent largeness of the moon near the horizon is of course a real illusion. It is often elaborately explained as due to the magnifying power of the layers of air through which the moon is viewed. In the "Wide Wide World" the overwhelmingly wise John Marchmont explains the matter thus to Ellen Montgomery (I hope my recollection of the names is trustworthy, but the book came out a long while ago, and I have not seen it since its first appearance). But the moon is not magnified at all in *that* sense. She does not occupy a larger space in the visual field. Nay she looks rather smaller when near the horizon, being then nearly 4,000 miles nearer to us than when overhead. It is easy to show this; and in passing I cannot too earnestly recommend those who wish to form correct ideas about the apparent sizes, shapes, positions, and movements of the heavenly bodies, to test such matters in simple ways such as I am about to suggest in the moon's case. Cut out in card a circle exactly half an inch in diameter, leaving a projecting piece of card outside some part of the rim. Then take a straight rod about 54 inches long, and with a tack through the projecting piece fasten the disc at one end of the rod, so that the whole disc is visible from the other end. Now it will be found that if the rod be directed towards the moon, the disc of card at the end furthest from the eye, will just hide the moon from an eye placed at the nearest end. Whether the moon is high up in the sky or close to the horizon the same thing happens. The moon looks just as large high up as she does low down, on any given night. Of course, as the moon's path round the earth is not quite circular there is a change in the moon's apparent size in the course of each lunar month,—a change which the method of measurement just described will serve very well—rough though it is—to indicate. Just as the sun varies in apparent diameter as the year progresses, his diameter on January 1, bearing to his diameter on July 1 the ratio 31 to 30, so the moon varies as the month progresses, and in greater degree. But look at the moon from one end of the rod when she is rising and you will find the card disc at the other end cover her either exactly or very nearly, and when she is at her highest on the same night you will find her as exactly or as nearly covered by the card disc the rod being directed in the same way towards her, and the disc viewed by an eye placed at the other end of the rod.

Here then is an optical illusion by which the idea is conveyed that the moon is larger when low down than she is when high above the horizon, though in reality occupying as large (nay, even a slightly larger) portion of the visual field. It is the same with the sun, and the same also with any one of the familiar star groups which pass from close by the horizon to a great distance above it. How is this deception to be explained?

The increase of the moon's size near the horizon has been attributed to the circumstance that when she is low down we can compare her apparent size with that of known objects near the horizon, and seeing that she looks larger than many objects which are known to be really large, as trees, houses, and so forth, we can judge that she is larger than we had (unconsciously) supposed her to be when high up. But I cannot see that there is any force in this explanation. It is true that if the moon when low down is looked at through a tube of any sort, hiding surrounding objects, she no longer appears so large. But this does not prove that the surrounding objects make her look larger, other relations besides those depending on the appearance of surrounding objects are concealed by the tube; and amongst them that which is, I take it, the true explanation of the moon's apparent increase of size.

The fact is that the increase in the apparent size of the moon and other celestial objects as they draw nearer to the horizon is connected with a much wider illusion affecting the apparent dome-shape of the sky over our heads.

Of course when we look at a cloud-laden sky we perceive at once that our range of view is not limited by the interior of a hemispherical surface. The region above our heads seems shaped like the interior of a very much flattened dome, the horizon being much farther away than the sky directly overhead. When the sky is clear the dome above us seems more arched, but it never appears like a true hemisphere. Probably to ordinary eyesight the star-strewn sky on a clear night appears shaped as though the part directly overhead were at only about one-quarter the distance of the part near the horizon. But of course the range of the moon's path around any observer on earth is such that her distance varies very slightly, as if in fact she always moved on the inner surface of a sphere having the observer at its centre. To one then who entertains unconsciously the erroneous notion that the sky is arched over the earth, in such sort that the region overhead lies at about a fourth the distance of the horizon, the expectation unconsciously arises that when the moon is close to the horizon she will present a smaller disc than when she is high up in the sky. As a matter of fact, she looks about as large (not quite, but very nearly), that is she subtends the same visual angle; but the effect of her looking so much larger than had been unconsciously expected, is to suggest that she is really larger than when high above the horizon. We apply to her the same unconscious reasoning by which we recognise that a tree on the horizon which subtends the same apparent angle as a tree close by is much the larger of the two. Having in reality no means of estimating the real size of the moon we make its apparent position guide us to an idea of its size, and as it seems—being near the horizon—much farther away than when high, yet looks no smaller, we judge it to be really larger.

(To be continued.)

TRICKING THE CONDORS.

THE favourite resort of young men in Clyde, N.Y., is a conspicuous long red boat-house, opposite the West Shore Depot. A half-dozen were there last night listening to the stories of Ned Conroy, one of the young men of this place, who has travelled all over the world. He has just returned from South America, bringing considerable money. When asked how he got it, he said:—

"Shooting condors in Chili. The Government pays 5 dols. for every condor's head brought in, but most of the hunters soon get sick of the business. The condors are thicker than buzzards, but they can see a rifle farther than a man can see a house, and they catch on to all

sorts of ambushes in the neighbourhood of a dead carcass almost before they are made. The nests are 12,000 ft. above the level of the sea, so it's little use to hunt them in the mountains. They are trapped occasionally, and some are poisoned, but as a rule the business doesn't pay, and the condors increase in number."

"How do you manage it?" he was asked.

"By playing off sick. Along the coast there are great stretches of sand, without vegetation, which are perilous to cross at all times, because of the heat and the liability of getting lost. It was my plan to start out at night, well provided with water, and seek a place under a big rock, where I could find shelter, and to which I could return by landmarks. At midday I would start out in the broiling sun, walking briskly, and describing a large circle. It was very easy to stagger after awhile and fall and then get up and stagger on again, keeping a good look-out for the birds all the time, lest one should suddenly drop on me from behind. It would take a very short time to bring them swooping around, waiting for the death of what they supposed was a worn-out traveller. Many a poor fellow has fallen down there on these sands and been torn to pieces before he was dead.

"When I found them getting thick I'd back up against a rock and throw stones at them and shout as if I was wild with fear, and the great vultures would gather round just out of range of the stones, which I didn't throw very hard, and sit on the sand, and look at me sideways. Then was my opportunity. Pulling two navy revolvers from under my coat I'd let drive at them. They are wonderful in the air, but to get aloft they must first run along the sand with wings spread for a couple of rods. It was a cold day when I didn't get at least three, and one day I captured seven. That was a trick the condors didn't learn easily."

PLEASANT HOURS WITH THE MICROSCOPE.

BY HENRY J. SLACK, F.G.S., F.R.M.S.

IT is a common notion that a dingy sky with a warm temperature constitutes a "blight," though the numerous persons who speak in that manner have no clear idea of what they mean. "How dark it is this morning," says one member of a family, and another more knowing exclaims, "It is a blight!" The proof, or what passes for such, is easy; the young rose-buds, which were clean and flourishing yesterday, now exhibit a swarm of little green insects, and they soon cover up many inches of the stems. Perhaps a cherry-tree that promised a successful ripening of abundance of fruit has all its leaves, especially on the under side, so densely infested with little aphis niggers that the surface cannot be seen. At another time there may be no insects noticeable on the upper surface of the leaves of greenhouse plants, or forest trees, but they are quite sticky with honeydew, and plant-lice of one sort or another will be found underneath. On another occasion the branches of a pear-tree will be coated with brown scales like minute mussel-shells, or an apple-tree may show little tufts of hairy substance like cotton wool, indicating the presence of coccidæ, commonly called bugs.

The so-called "blight" often takes the form of caterpillars, or may be only the effect of a cold dry east wind following quickly upon a warm, moist, south one, and shrivelling up the leaves. If the air is muggy, the mischief may be done by a rapid development of minute fungi belonging to the family of moulds. All these, and many more, attacks upon vegetation are lumped together as "blights"; but although the verb to blight may be justly used to describe the injuries without reference to their causes, it only leads to confusion to talk of "a blight" as if it were one particular disease.

The gardener's most formidable blighting enemies in this country belong chiefly to the insects with sucking mouths, though at times biting caterpillars, or biting beetles are the chief offenders. The farmer's foes are, perhaps, more numerous than the gardener's, and they have been treated by Curtis in his well-known book "Farm Insects," and in Miss Ormerod's more recent investigations.

The very numerous species of plant-lice—aphides and their allies—are all characterised by wonderful powers of multiplication. To start with a dozen is to be on the high road to millions. Each prolific female, whether wingless or winged, rapidly produces offspring, and before the infants are born they contain yet other infants in an earlier stage. For example, we take a cherry-leaf infested with *Mysus ribis*, and carry off one of the black adults on the point of a needle, and place it in a drop of water on a slide. Pressing the abdomen will most likely discharge several infants, some showing the limbs closely folded up, and others in a more advanced stage. Babies rolled up and swaddled, as is still the barbarous custom in many parts of the continent, are not unlike the young plant-lice before their legs and antennæ are free.

From the cherry-tree we may go to the currant-bush and find its leaves deformed with ugly bubbles. These are the work of another aphis, and the creatures abound under the shelter thus obtained. The roses will supply another species, and a search from tree to tree and from herb to herb, wild or cultivated, will be rewarded by the discovery of still different kinds. The wonderfully painstaking work of Mr. Buckton, "A Monograph of British Aphides" describes and figures well-nigh 140 species of the genus aphis, and other genera add largely to the total number of these plagues found in this country. Happily they have active enemies, or they would soon reduce Great Britain to a desert; but neither birds nor carnivorous insects make any visible impression on the swarms that surround the rose twigs and buds, or that cover the leaves of the currant or cherry. Some recent experiments lead the writer to hope that Sanitas may be found of great service in keeping down their numbers. An ounce of the Sanitas Oil should be shaken up with a wine bottleful of strong solution of the common soda used in washing, and one ounce of this mixture added to one gallon, or two, of water and applied to the plants with a fine rose attached to a watering-pot or syringe. The stronger mixture does not seem to hurt rosebuds or cherry leaves.

The plant-lice (*aphidæ*), scaly bugs, meal bugs, and cotton bugs (*coccidæ*), with other bugs that plague plants, belong to the *Homoptera*. The winged insects of this order have four of these organs, which are altogether membranous, and this distinguishes them from the *Heteroptera* of Westwood's classification, which have the lower part of the anterior wings coriaceous, or leathery. The British representatives of this order are figured and described in Douglas and Scott's work, "British Hemiptera." All the Homopterous and Hemipterous insects, and also the Thrips of all kinds, have mouths constructed upon one principle, and exhibit a projecting rostrum, or snout, containing very fine bristles, representing the man-

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dibles and maxillæ of the biting insects. They differ from the sucking mouths of the gnats, because the piercing tools of the latter are like lancets, knives, and saws. The fleas, likewise, have beautiful saws, but the plant plagues we are now considering depend upon the extreme fineness of their setæ, or bristles, and their wonderful strength in proportion to their extreme slenderness. The end of the snouty proboscis is furnished with some sense-organs, and, when a spot is selected for invasion, it is pressed *against* the leaf, but not *into* it, and the fine bristles wriggled in. They not only make a minute hole, but irritate the plant and cause its sap to flow. The coccus family are remarkable for the low condition of their adults. They lose all power of motion, and without careful examination with a magnifying-glass would be taken for dead masses. The Scale-bugs bring up their offspring under the cover of the mother's body. The full-grown mealy-bugs, cotton-bugs, &c., have the same degraded character. The mischief they do is conspicuous enough, but it should be remembered in favour of these creatures, that a Mexican species which feeds upon a cactus gives us cochineal, and others supply the different kinds of lac.

Another set of plant foes which came under the general term of "blights," belong to the *Arachnoideæ* or spider-like creatures consisting of mites and their allies. Any one who has observed a cheese-mite under the microscope will easily recognise most of these creatures. In their adult stage the great majority have the spider's allowance of eight legs, but only six in earlier states. The most tormenting to the gardener is the so-called "Red Spider" that does great harm in melon-beds. The young ones are yellowish, not red, and readily distinguished from the aphides by their greater resemblance to minute spiders. They have sharp pointed snouts. In Andrew Murray's interesting work entitled "Economic Entomology" he gives the figure we copy, and also another from Claparède, showing the snout like that of the Dog Tick furnished with reversed barbs; this I never saw in the Red Spider, though I have examined a good many.

Mites attack the leaves of the lime, the vine, and many others, producing little bubbles, under which they may be found. It would occupy a life to study all the species of these various plant-plagues, but the main characters of the different orders are easily recognised. The aphides puzzle the beginner with their winged females and males, which are quite unlike the wingless females, and usually very beautiful from their large and iridescent organs of flight. Winged specimens early in the season are most likely viviporous females; later they may be males; and for further particulars we must refer the inquirer to Mr. Buckton's admirable work. Dissecting these soft small things is a delicate task, but even rough squeezing in a water-drop will show a good deal, and for creatures which lead inactive lives, except in the matter of feeding themselves, the extent of their tracheal or tube-breathing apparatus is very large. The plentiful aeration is necessary to maintain the activity of the generative process. The tracheal tubes, with their spiral wire to keep them extended, are recognised by their glittering aspect, and require a magnification of 500, or so, linear, to show them well. A beginner should familiarise himself with their aspect in larger insects, or he may miss them altogether in the smaller ones.

The leaves of greenhouse plants, as well as those of fruit and other trees, are often found spotted over with the sweet tenacious fluid called honeydew. This sticky substance stops up their pores, and produces much damage. It is certainly known to be produced by aphides, but whether all that is found has that origin, or some is simply an exudation from the plants, is still in dispute, though the aphis origin is the most probable. The aphides usually occupy the under surface of leaves, and from that position they may easily drop the fluid on the upper side of the leaves below them. But leaves are frequently found in a great mess from abundance of the honeydew when there are no others above them; and this leads to the opinion that the plants have exuded it in consequence of some disease. When it first appears, however, no symptom of such disease is recognisable,

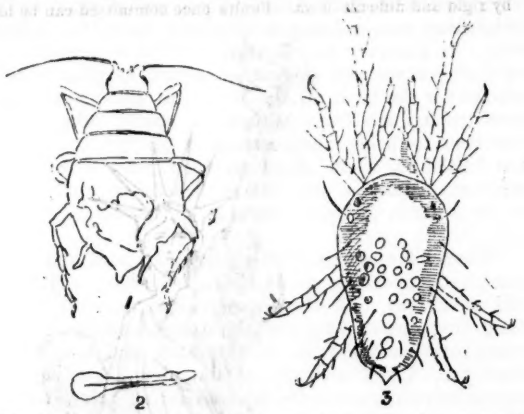


Fig. 1. *Mysus ribis*, outlined after Buckton. The insect is quite black.

Fig. 2. Its rostrum. The fine bristles are in the middle, and can be protruded a considerable length when required.

Fig. 3. *Tetranychus telarius*, or Red Spider, as given by Murray from Claparède.

but the leaves soon become sickly and the sweet stuff is favourable to the growth of that greenhouse pest, the black fungus, *Fumago varians*. Mr. Buckton inclines to the aphis origin of honeydew, and observes: "Even when no aphides are feeding above, myriads of the winged forms often fill the air on a hot summer's day, and void their juices while on the wing, just as we see in some of the lepidoptera." The sugar in honeydew has been identified by Bonssaingault as of the cane sort. Bees do not take any notice of it so far as my observations go, although it may be plentiful close by the flowers they frequent.

COLOSSAL SCULPTURE.*

By M. Bartholdi.

I THINK that it may be timely to examine briefly the characteristics of colossal statuary, in view of the fact that the art has from time to time been the object of criticism. Many persons see in it only a striking production, and do not understand its peculiar laws, its difficulties, nor its artistic value.

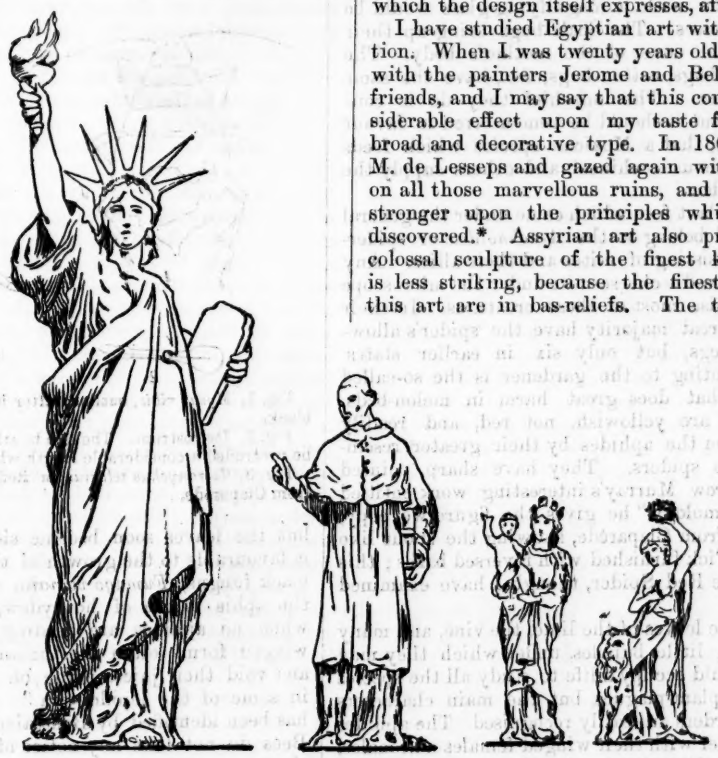
Colossal statuary does not consist simply in making an enormous statue. It ought to produce an emotion in the breast of the spectator, not because of its volume, but because its size is in keeping with the idea that it interprets and with the place which it ought to occupy. It should be used only in dealing with a limited order of ideas. M. Lesbazeilles, in his work on the Colossi has

* From the *New York Tribune*.

said with reason: "It is within its scope when it represents power, majesty, infinity. It can lay claim to that class of effects which are produced in us by the heaving of the boundless sea, the bellowing of the wind, the rolling of the thunder."

Also M. Charles Blanc, the celebrated art critic, says on the same subject:—

Colossal statuary calls for faculties of peculiar power. It is an art of an exceptional character, which presents considerable difficulties. The artist who approaches these difficulties enters a sombre temple, peopled with mysteries. He is brought face to face with struggles which few artists have experienced. No one can advise him, nothing can guide him except his instinct, his faith, and his courage. Conception and execution are controlled by rigid and difficult laws. Faults once committed can be hidden by no subterfuge, and if the artist fails the depth of his fall is commensurate with the immensity of his aspirations. Instead of producing many works in which he may attain success in a variety of ways, he exhausts a large part of his life upon a single task, on which he pours out all his treasures of passion, of study, and of enthusiasm. With these he must without pause keep up his ardour during long years.—[Charles Blanc in *Le Temps*.



Comparative height of the great Colossal Statues without their pedestals. Statue of Liberty, 46·08 mètres; St. Charles Borromeo, 22 mètres; Virgin of Puy, 16 mètres; Bavaria, 15·70 mètres.

These words seem to me to answer in a large measure the criticisms of which colossal art is sometimes the object.

Without wishing to make a detailed study of the colossal statues which have been produced, I think that it might be interesting to the reader to recall rapidly the most remarkable works of this kind of past times. Egypt incontestably gives us on this point the most complete instruction, and we can judge Egyptian colossal art with our own eyes.

To all those who have studied it, Egyptian art has been the object of profound admiration, not only in view of the masses, the millions of kilogrammes moved by the Egyptian people, but on account of its concrete and majestic character, in design and in form, of the works which we see. We are filled with profound emotion in presence of these colossal witnesses, centuries old, of a past that to us is almost infinite, at whose feet so many generations, so many million existences, so many human glories, have rolled in the dust. These granite beings, in their imperturbable majesty, seem to be still listening to the most remote antiquity. Their kindly and impassable glance seems to ignore the present and to be fixed upon an unlimited future. These impressions are not the result simply of a beautiful spectacle, nor of the poetry of historic remembrances. They result from the character of the form and the expression of the work in which the design itself expresses, after a fashion, infinity.

I have studied Egyptian art with the greatest attention. When I was twenty years old I travelled in Egypt with the painters Jerome and Belly, and several other friends, and I may say that this country had a very considerable effect upon my taste for sculpture of the broad and decorative type. In 1868 I went back with M. de Lesseps and gazed again with the same pleasure on all those marvellous ruins, and my convictions grew stronger upon the principles which are there to be discovered.* Assyrian art also presents specimens of colossal sculpture of the finest kind, only its effect is less striking, because the finest remaining types of this art are in bas-reliefs. The taste for colossal art certainly made its way into Greece along with many other artistic traditions which came from Assyria, as well as from Egypt. Archæologists have often asserted this relationship. Phidias executed two colossal statues, in which he succeeded in uniting material grandeur with a true ideal of beauty of form. The statue of Minerva in the Parthenon measured thirty-seven feet, and that of the Olympian Jove forty feet. They have both been regarded

* At this period I was expecting to execute a statue of Egypt for the Suez Lighthouse. I even laid before Ismail Pasha a project. It was this that made an evil-disposed newspaper say, and others repeat, that I had executed a colossal statue for Egypt, which had not been used, and that I had resold it to the Society of the French-American Union, in order that from it might be made the Statue of Liberty. Now, I never executed anything for the Khedive except a little sketch which has remained in his palace, and which represents Egypt under the features of a female Fellah. Besides, every one has seen the model of the Statue of Liberty made at Paris, and only evil-disposed persons are ignorant of what it has cost me. I have never answered these small cavillings, but I think that I ought to notice them on this occasion.

as masterpieces of chrys-elephantine sculpture (otherwise called sculpture in gold and ivory). All the ancient authors, Pausanias, Pliny, Quintilian, have spoken of them with much enthusiasm, and in terms which leave no doubt of the value of those works and of the profound impression which they produced on the Grecian world. The other admired works of that period which have come down to us permit us to consider them good judges.

The most celebrated colossal statue of antiquity was the Colossus of Rhodes. We may consider it as having been a very remarkable piece of work, independently of the fantastic legend of the ships which passed between its outspread legs. This legend, whose origin is not older than the sixteenth century, has been exploded by archæologists; nevertheless we may add to their observations a demonstration founded on simple good sense. First, if the Colossus was placed with its legs apart above the water, when it was overthrown it would have fallen into the water, and the enormous fragments, resembling caverns, of which Pliny speaks, would not have been gotten out, leaving within the stones, themselves enormous, which he says he saw there; second, the result of my personal studies shows that the placing of a statue of this kind in an upright position would be almost impossible, but that it would be absolutely so if stones were placed in the body, which would result in bringing the centre of gravity too high.

After the Grecian epoch we must pass on to modern times to find examples of colossal statues. The Jupiter Pluvius of the Pratolino Villa, executed by John of Bologna, and the St. Charles Borromeo on the Banks of Lake Maggiore, may be referred to. It cannot be said that this last work is properly included under the head of colossal art. It is an ordinary statue enlarged, and its volume gives it its principal interest. The pedestal is deplorable, and nothing in the whole work shows either research into the principles of colossal art or a comprehension of them. Nevertheless, this work of art has a peculiar interest in virtue of its material execution. It is, I think, the first example of the use of *répoussé* copper mounted on iron trusses. In ancient times metal beaten out into sheets had already been used. But it was used as a covering or was modelled on a solid form of wood or stone. Gold, silver, and copper were thus employed in Grecian antiquity and in the extreme Orient. The statue of St. Charles Borromeo is the first known example of a statue of *répoussé* copper, worked with the hammer on the inside and outside, and freely supported on iron beams. The work was executed in a somewhat coarse style, but it is interesting, and has the merit of being the result of a bold initiative. The copper is a little thin, measuring only a millimètre in thickness, and yet the whole work has stood until to-day—that is to say, for two centuries.

All the other colossal statues in existence are entirely modern. That of Bavaria is the oldest. It measures 15·70 mètres. Next was executed the colossal statue of the Virgin of Puy, which is 16 mètres in height; and, finally, that of Arminius, in Westphalia, which, including the sword which he raises towards the sky, is 28·30 mètres in height.

The object of this review of the colossal statues which have been produced up to the present time is to bring back their image to our eyes, and to enable us to deduce from them some principles which seem to be essential in colossal art. The understanding of these principles and their interpretation may vary somewhat, according to the sentiments of the artist. Yet some of them seem to me to manifest themselves in a way which admits of no discussion. They are to be found: First, in the character or the thought of the subject, which ought to be in harmony with the size of the work; secondly, in the suitableness of the site and the surroundings of the monument; thirdly, in the understanding of the lines and the make-up which in colossal works of art are rendered necessary by the execution. On the first point I will recall the words of M. Lesbazeilles, which I cited above, when he says that colossal statuary ought to be used only to symbolise figures or thoughts which are grand in themselves, and as far as possible abstract. The immensity of form should be filled with the immensity of thought, and the spectator, at the sight of the great proportions of the work, should be impressed before all things else, with the greatness of the idea of which these ample forms are the envelope, without being obliged to have recourse to comparative measurements in order to feel himself moved.

In regard to the choice of site, a study should be made of similar existing works in order clearly to perceive the most favourable conditions. The frame should lend itself to the subject. It may be made up or improved by architectural effects, by the flights of stairs which lead up to the statue and contribute to the monumental character, but above all, a site favourable by its own nature should be sought. There is an instinct which ought to guide the artist, for he ought to turn Nature to account in such a way as to make her contribute to the aspect of the monument. The neighbourhood of large masses should be avoided. The artist ought to choose his site in such a way that the lines of the ground and the colouring of the background will become his assistants in heightening the proper appearance of his work and the impression which it is to produce.

In regard to the execution of colossal works of art, I think, as I said above, that we find sure principles in the ancient works. The difficulty is to apply them to one's own age—that is to say, without servile imitation of the forms imagined by other epochs and other races.

I may cite, for example, the principle of great simplicity in the movement and in the exterior lines. The gesture ought to be made plain by the profile to all the senses. The details of the lines ought not to arrest the eye. The breaks in the lines should be bold, and such as are suggested by the general design. Beside, the work should be as far as possible filled out, and should not present black spots or exaggerated recesses. The surfaces should be broad and simple, defined by a bold and clear design, accentuated in the important places. The enlargement of the details or their multiplicity is to be feared. By exaggerating the forms in order to render them more clearly visible, or by enriching them with details, we would destroy the proportion of the work. Finally, the model, like the design, should have a summarised character, such as one would give to a rapid sketch. Only it is necessary that this character should be the product of volition and study, and that the artist, concentrating his knowledge, should find the form and the line in its greatest simplicity.

These same principles ought to be kept in mind in the construction of the pedestal, for they exist in architecture. I could, if I were not afraid of being prolix, cite examples of remarkable edifices, in which the enlargement of certain details or the lack of simplicity in the lines prevents the spectator from appreciating at first sight the monumental proportions of the edifice.

These are subjects on which there might be much said. I thought that it would be well to touch lightly upon them, not with the pretension of laying down

principles, but to show the thoughts which animated me, the artistic considerations and the ideals by which I have sought to be guided in my work.

(To be continued.)

Gossip.

BY RICHARD A. PROCTOR.

THE "Glorious Fourth" of July, or Independence Day, has just been celebrated throughout the United States in the customary manner,—that is, like a magnified Guy Fawkes' Day. The number of fires caused by accidents with fireworks has been rather below the usual average—not more, in fact, than eighty have been announced up to the moment of my writing this. For the whole Union this is not so bad. Personal accidents have, of course, been much more numerous; but then the chances are that most of the injured belong to the more foolish sort in the community. If we imagine an accident to every Guy Fawkes' crew on November 5th next, we can see that the loss would not be great even though many of the accidents were serious. This would certainly be the case if only grown persons—engaged in Guy Fawkes nonsense—suffered: for a man must necessarily be an idiot who takes part in such proceedings. In America grown rowdies take so large a share in Fourth of July displays, that the more sensible part of the community are tempted to positively pray for accidents.

OF course an Englishman is bound to be gratified by the earnestness of Americans in celebrating the establishment of American Independence—the last work of the purely British people in the original 13 provinces. So the achievement may fairly be described, for the men who wrote and signed the Declaration of Independence, those who accepted it, and those also who fought and bled for it, were British until the work was done, and therefore the accomplished work was a British achievement, the greatest gift the English-speaking race has made the world—one may even say, the greatest gift ever made to the nations.

POSSIBLY not every one in America on Saturday, the 4th of July last, viewed the matter precisely in this way. There are so many persons of German, Swedish, French, and other foreign blood in the United States, so small a proportion of the people can claim descent from those who established independence here, that probably a good deal of ignorance prevails in America as to the history of the struggle for independence. I find, indeed, that many imagine, or speak and write as if they imagined, that it was the present mixed population of America which fought and bled for independence a century and more ago,—and not the British inhabitants of the thirteen British American provinces. They talk, strange to say, of "us Americans whipping you Britishers," not knowing (it would seem) that the real struggle was between Britons who had settled in America, and Britons who had remained in the old country. There was no America in the modern sense of the name, before the Glorious Fourth.

THE Town Councillors of Hamburg have adopted without debate the proposal to allow cremation in place of burial.

Reviews.

SOME BOOKS ON OUR TABLE.

On Light as a Means of Investigation. By GEORGE GABRIEL STOKES, M.A., F.R.S. (London: MacMillan & Co. 1885.)—This is a reprint of the second series of discourses on light, delivered (as "Burnett Lectures") in Aberdeen last December, by Professor Stokes, and deals with light as a mode of investigating the molecular structure of bodies, their chemical constitution, the intimate structure of the sun and comets, and celestial motions of approach and recession. It is superfluous to add, what, in fact, is guaranteed by the mere name of their author, that these lectures are at once lucid and accurate. The young astronomer will find much to interest him in the account of spectroscopic research, and the knowledge with which it has supplied us of the nature of nebulæ, comets, our own sun, and those others which we call the fixed stars; in fact, Professor Stokes's little volume should be upon the shelves of every student of physical science.

Shall we Hang the Insane who Commit Homicides? By CLARK BELL. Reprinted from the *Medico-Legal Journal*, New York.—Mr. Clark Bell is apparently severely exercised in his mind about the hanging of a certain Dr. Beach on Feb. 12 last, at Holidaysburgh, in Pennsylvania, U.S., for the trivial offence of murdering his wife by nearly severing her head from her body. Dr. Beach may—or may not—have exhibited symptoms of eccentricity, numerous witnesses, however, testifying to his perfect sanity; but, of course, the question for the jury really to decide was: when this man committed the murder, did he, or did he not, know that he was doing wrong? It is time that a stop was put to the vagaries of the fussy and noisy clique of mad doctors (we beg their pardon, "Alienists" is the last designation they have coined for themselves). Happily now in England we have at last got a Home Secretary possessing a fair share of common sense, and sufficient independence not to be "squeezed" or to truckle to external opinion in this and cognate matters.

The Mersey Tunnel; its Geological Aspects and Results. By T. MELLARD READE, C.E., F.G.S. (Liverpool: C Tinling & Co. 1885.)—Twelve years ago Mr. Mellard Reade enunciated the theory that the rocky bed of the Mersey between Warrington and Liverpool was a river valley, and that there was a deep depression or gulley in the river between Birkenhead and Liverpool filled with drift. Now that the Mersey Tunnel works have revealed the existence of this pre-glacial valley and the depression whose existence he affirmed, he exhibits, not wholly unnaturally, no little gratification at so literal a fulfilment of a prediction founded on theoretical grounds; and it is to a somewhat detailed account of the nature and stratification of the deposits intersected that his pamphlet is devoted. It will repay perusal by all interested in the geology of the neighbourhood.

The First Three Years of Childhood. By BERNARD PEREZ. Edited and Translated by ALICE M. CHRISTIE, with an Introduction by JAMES SULLY, M.A. (London. W. Swan Sonnenschein & Co. 1885.)—M. Perez has given us a work of exceptional interest, alike to the psychologist, the evolutionist, the parent, and even the general reader. Obviously passionately fond of children and animals, he has arrived at his facts strictly by observation and experiment, with the result that he has made a contribution of real and enduring value to the science of

infant psychology. Every reader of the volume before us (which means, we are persuaded, every one who ever opens it) will find his (or her) interest and attention so secured and stimulated that he (or she) will almost certainly attempt to repeat the observations so delightfully recorded by our author. His book is crowded with illustrative anecdotes of his pets and protégés; and his comparison of the intellectual development of the human infant with that of the young of other animals is at once most suggestive and instructive. In his excellent introduction Mr. Sully points out the advantage which must accrue to science by multiplied observations of the character so pleasantly recorded by M. Perez; and expresses a hope that the work of the able Frenchman may stimulate individual research in the same field on this side of the Channel. He goes on to add that there is an English journal of psychology whose editor "has proved his readiness to publish contributions to the young and promising science of baby-lore." Verbum sat sapienti.

The Black Forest: Its People and Legends. By L. G. Séguin. Third Edition. (London: Hodder & Stoughton. 1885.)—The reader who, after the perusal of Miss Séguin's charmingly chatty volume, can resist making the Black Forest the scene of his very next holiday tour, must either be adamant against temptation, or must be wholly wanting in the pecuniary means for making the journey thither. For it would be difficult to find a guide-book which better justifies its *raison d'être* than hers; and her descriptions of the grand and romantic scenery, of the manners and customs of the primitive people who live amid it, and notably her way of relating the many legends so rife where the teachings of the Royal Institution are as yet unknown as the Vedas, being in their way models of what they should be. Six clearly-printed maps and thirty-four engravings of scenery illustrate the text. To those, then, who are seeking for some change from the beaten track of the ordinary continental tourist, we would commend the study of the volume whose title heads this notice. Our authoress assures them that in the birthplace of the cuckoo-clock and the musical-box, they will meet with the simplicity which pertains to all such primitive people as are yet untouched by modern civilisation; and that in the unpretentious inns which will form their abiding-places they will find hospitality, brilliant cleanliness, honesty, and low charges—qualities not invariably and inseparably united in the bigger hotels of more familiar European cities.

Results of Rain and River Observations made in New South Wales during 1884. H. C. Russell, B.A. (Sydney: Thos. Richards. 1885.) Within the sixty-one pages of Mr. Russell's volume is comprised a mass of statistics of very considerable interest to the meteorologist and hydrologist. Messrs. Balfour Stewart and W. L. Carpenter may (or possibly may not) be glad to learn that of a year of maximum sun-spots, we find the Government Astronomer of New South Wales writing: "Judged by its mean rain-fall, 1884 must be counted a very dry year, the rainfall record for the whole colony being, as we have seen, some 30 per cent. short of the average."

Comets, Indications of Ring Structure. By George St. Clair, F.G.S. (Reprinted from the Proceedings of the Birmingham Philosophical Society. Vol. IV. Part II.—Mr. Sinclair has expended a good deal of ingenuity in an attempt to show that a comet consists of a mass of meteoric stones revolving in a series of shells round a central nucleus, and that by solar action these shells are pulled out into very elongated ellipses, with their major axes, or lines of apsides, passing through the nucleus and the sun. He cites the Saturnian ring system in illustration of his hypothesis, and adduces it to explain many of the curious phenomena so familiar to all who have studied comets telescopically. But he himself speaks of "the extremity of the tail—fifty or a hundred millions of miles from the head"; and one would be curious to see his dynamical proof of the possibility that any such nucleus as has yet been observed could exercise gravitating power over an aggregation of matter which, if his hypothesis be correct, must be *indefinitely heavier than itself!* The mass of Saturn's ring system (as determined by Tisserand, in 1877) is only ·0016 that of the planet: but with the condition of things reversed, we should, with Mr. St. Clair's hypothetical comet, get into the condition of Lord Dundreary's dog, of whom that lamented nobleman remarked that, "if he didn't wag hith tail, hith tail would wag him!" We fear that this fresh hypothesis will have to go to that bourne whence Professor Tait's quoted one will never return.

Scientific Romances. No. 2: "The Persian King, or the Law of the Valley." By C. H. Hinton, B.A. (London: Swan Sonnenschein & Co. 1885.)—Mr. Hinton was so very good in the first of his "Scientific Romances" (which we reviewed on p. 510 of our Sixth Volume) that he suffers a little by comparison with himself in the second one now before us. Under the allegory of a king who brings a great empire into existence, our author expounds the doctrine of energy in a manner perhaps better calculated to convey sound notions on the subject to the general reader than it has heretofore been presented in. We say advisedly the general reader, because to the student of science a little more advanced, books are open which deal perspicuously and in detail with that doctrine. But this second little volume needs harder thinking and more watchful perusal than the first one did to enable its drift to be apprehended. Both the mathematician and the experimental physicist will find a very subtle hypothesis as to the real nature and meaning of the conservation of energy developed in the concluding chapters.

Bright Days. Holiday Number of *Cassell's Magazine.* (London: Cassell & Co.) Here is a charmingly illustrated and readable book, to be enjoyed under the shade of a spreading tree or on the beach to the accompaniment of the plash of the waves. Nine stories, as many articles, and a few notes make up the number, which will surely be seen in many a railway-carriage and on many a steamer's deck during the forthcoming holiday season.

Leaves from the Note-book of Thos. Allen Reed. Vol. II. (London: F. Pitman. 1885.)—This is a continuation of the history of Mr. Reed's reporting experiences, the first volume of which we noticed on p. 346 of our own sixth one. As in that case, the work is given throughout in the characters of reporting phonography, a printed key in ordinary type appearing at the bottom of every page. This book possesses a certain value for the student of stenography, inasmuch as there are, perhaps, not half-a-dozen dry pages in the whole volume, and the pleasure of rendering an amusing story into shorthand or of reading it in that form is of necessity much greater than that afforded by the reproduction of a mere string of disconnected sentences. All who aspire to become reporters should buy it and its predecessor.

How to be a Successful Amateur Photographer. By W. J. Lancaster, F.C.S. (Birmingham: J. Lancaster & Son.)—Those who read the favourable notice of Mr. Lancaster's capital little manual on p. 204 of our last volume will not be surprised to learn that it has already run into its tenth thousand.

THE FACE OF THE SKY.

FROM JULY 31 TO AUGUST 14.

BY "F.R.A.S."

THE usual watch for spots and faculæ on the sun will be kept on every clear day. Map VIII. of "The Stars in their Seasons" exhibits the aspect of the sky after dark. Mercury is an evening star during the next fourteen days, and may be picked up after sunset close to the Western horizon. He is at his greatest Eastern elongation (27° 21′) from the sun at 3 a.m. on August 6. In the telescope he is becoming crescentic. Venus is an evening star too, and is a much more conspicuous object than Mercury in the same region of the heavens. She presents a small brilliant gibbous disc in the telescope. She is in conjunction with Mercury at 5 p.m. on the 8th, and is 3° 42′ North of him. The actual night sky so far as the other planets are concerned is now a blank, the whole of them being more or less in the neighbourhood of the Sun. The Moon enters her last quarter at 9h. 55·3m. p.m. on August 3, and is new fourteen minutes after noon on the 10th. No occultations happen within our prescribed hours during the period these notes cover. When they begin the Moon is in Pisces, which she quits for the extreme N.W. corner of Cetus at 10 p.m. on the 2nd, after travelling through which for eleven hours she emerges in Aries the next morning. At 2 p.m. on the 4th she leaves Aries and enters Taurus, her passage through which occupies until 1h. 30m. a.m. on the 7th, at which last-named hour she passes the boundary of the northern part of Orion. It takes her until 1 o'clock in the afternoon of the 7th to cross this, and then she enters Gemini. At 1 a.m. on the 9th she enters Cancer; which, at 11 a.m. on the 10th, she leaves in turn for Leo. In her passage through Leo she, at 6 p.m. on the 11th, descends into Sextans, re-emerging, however, in Leo five hours and a half afterwards. At 10 p.m. on the 12th she finally quits Leo for Virgo; across which great constellation she is still travelling when our notes terminate.

Miscellanea.

IN consequence of the enormous stock of beetroot sugar on the Continent, the East and West India Dock Company lost in the first half of the year no less than 22,000 tons of sugar-laden vessels from the West Indies as compared with the previous year.

A REUTER'S telegram dated Rome, July 23, says that during a violent thunderstorm at Torre Cajetani, a small market-town in the neighbourhood of Anagni, thirteen persons were killed and twenty-two severely injured by the lightning.

WE understand that Mr. Alexander Watt has been for many months engaged in writing a comprehensive practical treatise on the "Electro-deposition of Metals," including the electrolytic refining of copper and other metals and treatment of ores. The work, being now complete, will shortly be in the hands of the public. The publishers will be Messrs. Crosby Lockwood & Co.

A BIG BLAST.—A mass of granite estimated to weigh at least 500,000 tons was displaced recently on the line of the Iron Mountain Railroad, Missouri, by a single blast. A shaft 65 ft. deep was sunk, with lateral chambers in which five tons of powder were stored. After the shaft had been nearly filled to the top, an electric spark from a battery a half mile distant fired the magazine with the result indicated.

IT is said that there is a fair prospect that the works for the improvement of the Danube waterway will at last be undertaken. The commission of experts appointed to examine the means of removing the obstructions at the Iron Gates is nearly ready with its report, and meanwhile the Hungarian Government has granted 1,500,000fl. for dredging operations on the Hungarian part of the Danube. This money is to be recouped by tolls on shipping.

THE *National Car Builder* says:—"The Boston and Maine road has a new parlour car called the Magnolia. It is 60 ft. long, and is finished inside with mahogany. There are seventeen windows on a side. The seating consists of forty luxurious chairs upholstered in leather, each of which is numbered. It is proposed to sell them to the patrons of the road at 30 dols. per chair for the season of four months, an arrangement that proved very popular last year."

THE German Government are having a boring made near Schladebach for the purpose of determining the increase of the earth's temperature. The depth reached is more than 1,392 mètres, the lowest depth yet obtained by boring. The temperature at successive depths is ascertained by a new mercurial thermometer of most ingenious construction. It has been determined that the temperature at the depth of 1,392 mètres was 49° C., or 120° Fahr. At this rate of increase the boiling-point of water should be reached at a depth of 3,000 mètres.

THE coalfields of Russia are, Mr. W. Mather says, still practically undeveloped. The Donetz coalfield is too remote for the manufacturing districts, and the railroad communications are too uncertain to admit of its being largely used. The lignite found within a radius of 200 miles of Moscow does not offer fuel of a sufficiently good quality. It is a remarkable fact that during the past two years English coal has been found to be the most profitable fuel that manufacturers could use immediately around Moscow at a price laid down of about 40s. per ton. Twenty years ago the price of wood fuel was so low as to be equivalent to coal at 10s. per ton, and now coal at 40s. per ton is cheaper fuel. This is apparently a consequence of the reckless destruction of forests in Russia without systematic planting under Government supervision. —*The Engineer.*

IN the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, M. Carnot, in a report presented by him on behalf of the Committee of Chemical Arts, showed that the cause of the corrosion of sheet copper employed for the sheathing of ships is the presence of cuprous oxide, which, in contact with salt water, occasioned the formation of soluble salts, even when the air is excluded. In order to reduce more completely the oxygen compounds present in the copper, he introduces a small quantity of metallic manganese, which completely reduces the cuprous oxide remaining in the metal, and becomes converted into a manganese silicate, in contact with the sides and the sole of the furnace. If a few thousandths of manganese remain alloyed with the copper, they affect neither its malleability nor its resistance to the action of sea water. The manganese is introduced in the form of cupro-manganese, an alloy containing 75 per cent. of copper and 25 of manganese.

PRIZE AWARDED TO DR. BROWN-SÉQUARD.—It is the custom of the five Academies constituting the Institute of France to award a prize of 20,000 francs every two years. The prize is successively given to a scientist, a man of letters, a philosopher, an artist, and an archæologist. Every second year one of the five Academies selects a candidate, and, with the consent of the other bodies forming the Institute, awards him the prize—a prize, be it remembered, that such men as M. Guizot and M. Thiers were proud to obtain. The Académie des Sciences selected Dr. Brown-Séquard for the prize, and the Institute ratified the choice by a majority of sixty-seven votes, the numbers being seventy-four and seven. It must be a source of much gratification to Dr. Brown-Séquard to find that his efforts to extend our knowledge of physiology and pathology have been so ungrudgingly appreciated by the Académie des Sciences, as well as by the whole Institute of France.—*Lancet.*

IN the following figures are given, first, the sea-going merchant fleets of all nations, and, second, the steamships of all nations:—Great Britain, 22,500 vessels, 11,200,000 tons; United States, 6,600 vessels, 2,700,000 tons; Norway, 4,200 vessels, 1,500,000 tons; Germany, 3,000 vessels, 1,400,000 tons; France, 2,900 vessels, 1,100,000 tons; Italy, 3,200 vessels, 1,000,000 tons; Russia, 2,300 vessels, 600,000 tons; all nations, 46,000 vessels, 23,000,000 tons. Thus it will be seen at a glance how tremendously England outrivals every other marine Power. Her preponderance is even greater in steam vessels, as appears by this second statement:—All nations, 7,764 steam vessels, 9,232,000 tons; Great Britain, 4,649 steam vessels, 5,919,000 tons; France, 458 steam vessels, 667,000 tons; United States, 422 steam vessels, 601,000 tons; Germany, 420 steam vessels, 476,000 tons; Spain, 282 steam vessels, 305,000 tons; Italy, 135 steam vessels, 166,000 tons; Holland, 127 steam vessels, 155,000 tons; Russia, 191 steam vessels, 149,000 tons.—*The Engineer.*

THE employment of natural gas as a fuel by manufacturing concerns may, remarks the American *Railway Review*, mean more to our industrial interests than has been generally anticipated. "Great sums of money have been invested in changed plant by many heavy houses who figure upon material profits through the use of the novel fuel. Despite the dangers which the timid ascribe to its use, and the lack of absolute certainty as to permanence of supply, the heavy capitalists of Pittsburgh have enough faith to warrant these large expenditures. Some of the anticipated results in the way of savings have already made themselves felt. For instance, it is estimated by good judges that there are already 3,000 tons less of coal burned in Pittsburgh per day than there were before natural gas was used. This takes away a coal business of 2,500,000 dols. or more a year. One concern saves 100 dols. a day in wages formerly paid to men who wheeled out ashes. The decrease of smoke in the atmosphere is already noticeable."

XUM

"Let knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

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THE RUDDY ECLIPSED MOON.

[1839]—Referring to Mr. Proctor's papers on this subject, I still fail to understand how the "very own sun" can be *all* refracted and *all* be brought round and above the earth's horizon, and *all* thus seen from the moon, as shown in his diagram, spots and all, without radiating to the moon his normal amount of luminous and calorific energy, minus, of course, that intercepted by our atmosphere. The sun being thus optically removed from behind the earth, there would be no more solid earth shadow thrown upon the moon than upon a terrestrial object when we see the sun just above our horizon. If Mr. Proctor is right the accepted explanation of lunar eclipse, as due to the shadow of the earth falling on the moon, is all wrong. If *no part* of the sun is optically behind the earth (from the lunar standpoint) it can cast no shadow, nor even penumbra upon the moon.

My version of the accepted explanation is that given by Sir John Herschel, who ("Outlines of Astronomy," section 424) ascribes the ruddy hue of the moon to the twilight glow of our atmosphere, the lowermost strata of which, he says, "impart to all the rays they transmit the ruddy hue of sunset, only of double the depth of tint which we admire in our glowing sunsets, by reason of the rays having to traverse twice as great a thickness of atmosphere." I quoted these words, and maintained (I do so still) that, according to the explanation they expound, the moon should have been excessively ruddy on Oct. 4 last, when "the ruddy hue of sunset" was excessive.

I see now by Mr. Proctor's paper of July 17, page 46, col. 1, that he has come to the same conclusion as mine in the *Gentleman's Magazine* of November, 1844, where I said that "if the atmosphere is greedily appropriating the red rays which reach it from without, and using them for colouring itself by internal reflection or scattering," its transmission of such rays will be proportionally impeded. Here Mr. Proctor, evidently without knowing it, is controverting the accepted theory as expressed by Sir John Herschel, and confirming my exposition of one part of the subject.

On page 45, Mr. Proctor asks whether I have ever tried the experiment of heating a tufaceous surface to redness. My reply is that I have witnessed the experiment (of my own and others making) many thousands of times. When engaged as chemist to one of our largest iron works, I had continually before me puddling furnaces, reheating furnaces, steel melting furnaces, regenerative furnaces, &c., the efficiency of every one depending on the remarkable facility with which a tufaceous surface such as that of ganister, fire-clay, "bull-dog," &c., absorbs radiant heat, becomes red hot, yellow hot, or white hot thereby, and at the same moment, and with corresponding facility, re-radiates this heat on the steel or iron to be fused or welded.

Every reader of KNOWLEDGE has seen the same, on a smaller scale, every time he has turned his eyes towards an ordinary English fireplace lined with fire-clay. The most instructive are those ill-constructed examples where the back is tufaceous and the sides metallic. There, the radiations from the same burning coals make the tufa red hot while the iron remains black.

As to "the exceedingly rapid radiation" which Mr. Proctor seems to suppose refutes my idea of the heating of the lunar surface, he surely understands that such radiation is the correlative of absorption. The exceedingly rapid radiation proves a corresponding rapidity of absorption, and the active absorption which I claim for the tufaceous surface assumes, as a matter of course, the active radiation. The law of "exchanges"—one of the broadest and soundest generalisations of physical science—teaches us that when two radiating bodies are opposed to each other, both absorb and both radiate, but that, *cæteris paribus*, the absorption will vary inversely, and the radiation directly, with their respective temperatures, and thus, as Clerk Maxwell says, "heat will be lost by the hotter and gained by the colder bodies till thermal equillibrium is attained."

As Mr. Proctor still fails to understand the basis of my estimation of lunar surface temperature, I must surely have failed to make it generally intelligible, and will therefore state the numerical elements of the problem, but in doing so will take the figures of those who, like Mr. Proctor, deny the extension of ordinary atmospheric matter throughout space. The temperature of space, according to these is $-273\frac{1}{2}°$ C. or $-459{\cdot}13°$ Fahr. (I estimate it many degrees higher, but this goes against myself, as will be presently seen). Therefore all the difference between this and our terrestrial temperatures (neglecting stellar radiation) is due to solar radiations. Under a tropical sun at sea level a spherical body with a tufaceous surface (represented by the blackened bulb of a thermometer) rises when exposed to the sun to 150° or 180° Fahr., and even higher in the course of a terrestrial day. (On Saturday last the sunshine thermometer at Greenwich reached 155·5°. On Monday, 161·3°; the highest in the shade, 87°.) Taking the lowest figure, the total heat received is 459+150=609°. According to some authorities our atmosphere arrests one-third of the solar radiations. Others estimate double as much. Calling it one-half the absolute temperature of a spherical tufaceous surface if exposed freely to the sun without atmosphere obstruction, as at the moon, would thus be 1218°; or 1218−459=759° Fahr., *i.e.* 159° higher than my original estimate of 600°. This when only exposed for the period of terrestial daylight. I need not here discuss the question of how much the temperature would be augmented by the greater period of lunar exposure, though I have considered the effect of this, and may find occasion to explain it hereafter. At present I studiously limit myself to accepted figures, but as the lawyers say "without prejudice."

I have little doubt that my present heresy concerning the temperature of the moon will, in due course, share the fate of a closely resembling heresy which I perpetrated about seventeen years ago, and published in "The Fuel of the Sun"—viz., that of concluding on the basis of purely physical data that Jupiter, Saturn, Uranus, and Neptune are incandescent gaseous orbs like the sun, and enveloped in an atmosphere of cloud matter. Mr. Proctor and others have accepted this, as they will presently accept my red-hot moon.

As regards this same "Fuel of the Sun," 19-20ths of which Mr. Proctor says is out of the pale of science, I may add that in this conclusion he *now* stands nearly alone *among those who have read it*. Sir Charles Lyell, Sir William Grove, Sterry Hunt, and many others have estimated it very differently. Sir Charles Lyell was very earnest concerning it, making his friends promise to read it all through. He knew, as I knew well enough when I published it, that a book of such pretensions, written by an unofficial theorist, would not be looked at by the average scientific official, who is too wise (in his own conceit) to be instructed by an outsider.

An amusing example of this prejudice was afforded by a well-known writer, and one who swears by Sir Isaac Newton, who refused to look at the book on account of its "sensational title." Presently an old forgotten essay, by Sir Isaac Newton himself, is unearthed by Sterry Hunt, in which my sensational title is used by this great authority, and not only this, but my fundamental heresy—that of the universal diffusion of atmospheric matter—is propounded by Newton; and worse still, the primary idea which the whole of the twenty-twentieths of the book is devoted to working out was prophetically suggested by Sir Isaac Newton as that which should be thus worked out in solving the great mystery of the "solary fuel."

I thus lose some of my claim for novelty, though none for originality. This loss is more than compensated by such flattering evidence of intellectual sympathy with so great a man, to whom I am thereby impelled to say, as Jack Falstaff said to Prince Hal, "I shall think better of myself and thee during my life."

W. MATTIEU WILLIAMS.

EVOLUTION.

[1840]—It is difficult to make out what "Commentator" really means. His numerous letters, which would almost require a commentary written on them to be properly understood, have a strong flavour of mysticism and quite a theological odour. *Timeo Danaos!* Overlooking apparent inconsistencies and inaccuracies, the letters appear especially to involve misconceptions as to the nature of

cause and the nature of legitimate assumption. The fact of development itself, which is as certain as the theory of gravitation, does not appear, on the whole, to be directly attacked. (Mr. Charles E. Bell, in his excellent letter [1814], confirms my opinion as to the difficulty of making out "Commentator's" meaning.)

1. The real cause of any phenomenon is properly the *tout ensemble* of the conditions necessary to bring it about. But we seldom use the word "cause" in this sense; nor do we generally speak of the permanent essential properties of bodies as the cause of phenomena, although, in fact, they are necessary conditions; *e.g.*, we never say that it is the strength of the boiler-plates that drives the steam-engine. In speaking of cause we use the term mostly with reference to an antecedent, which, being introduced into a group of more or less permanent conditions, a certain consequent invariably follows it.

Further, there are proximate causes and ultimate causes; the ultimate or final cause of all, we can, of course, never understand.

"Commentator's" difficulties obviously originate in not discriminating the various kinds of causes. Natural selection is one of the proximate causes of evolution. The inherent potentialities of the organism, including "the million-times-proved-fact of variability," may be considered as a more or less permanent group of conditions, into which the antecedent, viz., natural selection being introduced, the consequent, viz., development results under certain circumstances. No doubt the organism has a power of adjusting itself to its environment, and by mutual interaction a modification of the organism takes place. Darwin probably did not give so much prominence to this fact as some of his followers, *e.g.*, Mr. S. Butler; but the fact, so far from being opposed to natural selection, is rather complementary to it; nature selects the fit—the fitness may have been acquired, so to say, accidentally or by adjustment—and kills off the unfit. But, indeed, adjustment is implied in the very conception of life. H. Spencer defines life as "the continuous adjustment of internal relations to external relations." It is, therefore, quite legitimate to say that natural selection is a cause of evolution.

"Commentator" appears in certain passages to insist on the inherent potentiality of the organism as the sole cause of development. It is certainly a condition of evolution, and is the unusual case in which the *tout ensemble* of the conditions is regarded as the cause; the inherent potentiality necessarily forms part of the cause. But what do we gain by talking in the vague language of which "Commentator" is so fond, about "predestined development," the "I am," &c., if we know nothing of the mode of operation of such forces? We have only, in another form, the celebrated explanation of opium causing sleep because it possesses soporific qualities. To say that organisms possess evolutionary energy, and, therefore, they develop, explains nothing. And "Commentator" himself is not quite satisfied with thus settling the matter, for he still calls out for "the cause, the cause," failing to distinguish causes that can be known from the final cause, which, as our knowledge is relative, must ever remain unknown to us. Darwin has shown us certain proximate causes of development, and others have further elucidated the subject. Why, then, should we despise causes that can be known, as "Commentator" would have us do, because we cannot reach the ultimate cause? It is as vain to cry after the final "cause, the cause, my soul," as for a baby to cry after the moon. We may well console ourselves when we compare the knowledge of the present day with that of former times.

"Es ist ein gross Ergötzen,
Sich in den Geist der Zeiten zu versetzen,
Zu schauen, wie vor uns ein weiser Mann gedacht,
Und wie wir's dann zuletzt so herrlich weit gebracht."

II. "Commentator" and "Gamma" [1766] appear to have but vague notions as to the nature of legitimate and illegitimate assumptions. J. S. Mill writes as follows with reference to hypothesis:—

"It appears, then, to be a condition of a genuinely scientific hypothesis that it be not destined always to remain as hypothesis, but be of such a nature as to be either proved or disproved by that comparison with observed facts which is termed verification. . . . I conceive it to be necessary, when the hypothesis relates to causation, that the supposed cause should not only be a real phenomenon, something actually existing in nature, but should be already known to exercise, or at least be capable of exercising, an influence of some sort over the effect."

Newton, however, among certain classes, is considered a higher authority than Mill. The following is the first of the celebrated "Regulæ Philosophandi":—"*Causas rerum materialium non plures admitti debere, quàm quæ et veræ sint, et earum phænomenis explecandis sufficiant.*"

According to these principles the assumption of natural selection as a cause of development is perfectly legitimate.

T. COMMON.

THE STILL SMALL VOICE FROM THE FOSSIL GREAT DEEP.

[1841]—Marvellous! this tiny "note of preparation"—as it were like the entrance of "the Son of God" into the world—the first appearance, amid all those unspeakable monster forms and giant-lives of the Triassic and Jurassic epochs, of mammalian life—the first relics of small marsupial animals, "allied to the Myrmecobius or Banded Ant-eater of New South Wales" (Geikie).

How did they come there?—"that is the question!"

Does not this confirm what was lately suggested:—"is it not monstrous to hypothesize? yon cat, *suckling* her kittens, was evolved out of yon pigeon in the chest beside her, *pumping* maize into *her* young!"

Horrific saurians, and bird-like reptiles (or reptilian birds) were the full-grown companions of these tiny marsupials. No wildest dogmatist of the Darwinian school would maintain that these charming creatures were lineally begotten of the Dinosaurs, Gnaliosaurs, Pterosaurs!—he must, therefore, *de novo*, fall back upon his ever-ready, all-too-convenient, Common Progenitor.

Now, I do submit, that the theory which maintains, the *Saurs* and these bijou marsupials were evolved from one and the same protoplasm demands rhadamanthine scrutiny, indeed; is bounden to furnish at least a scrap of *proof*.

With reference to Dr. Geikie's work, learned and laborious though it be, I cannot refrain from here entering a small protest. I never knew a book more greeted with flourish of trumpets, yet I find Hugh Miller—Scotia's happier Burns; with that heaven-born style, that aroma of fragrance lavishing (yet continently) more genius in one of his chapters than the Bigwigs in one of their books—Hugh Miller does not appear to be mentioned, *mirabile dictu!* in Dr. Geikie's chapter on the Old Red Sandstone; the Old Red! Hugh Miller's formation! he who *discovered* the Pterichthys, and whose honoured name Agassiz gave to that fossil (Pterichthys Milleri, "the Old Red Sandstone," p. 82—a prose poem if ever there was one); but Dr. Geikie does not give.*

The sketch too, of "Vesuvius from the sea" is so unlike that I did not recognise the mountain; though I have dwelt near it almost ten years.

ALEXANDER TEETGEN.

Ana Capri, Italy.

OCULAR SPECTRA.

[1842]—What on earth does Mr. Cave Thomas mean in letter 1815 when he writes: "The important fact that the *ocular spectra* have no external existence whatever does not as yet appear to be fully recognised?" Does he mean the *ocular spectra* are like Mahomet's coffin, suspended in mid space, acted on by neither the laws of gravity nor the rules of spiritland? Surely the fact is about as important as the fact that when I have a pain in my stomach I cannot show the doctor where it is, but when I cut my finger I can. Does Mr. Cave Thomas argue that because we see the sun above the horizon for a few minutes after it has set that what we see has no external existence or physical basis? Surely were our instruments sufficiently good should we not see actual molecular motion in the retina of the eye which sees the ocular spectra, and is not that motion the consequence of previous motion set up by the reflection of sunlight by the coloured figure?

JOS. W. ALEXANDER.

THINGS IN GENERAL, AND A FEW OTHER SUBJECTS.

[1843]—Our Prince of Paradoxers, "Hallyards," reminds me irresistibly of Mr. Lewis Carroll's walrus:—

"The time has come," the walrus said,
"To speak of many things;
Of shoes, and ships, and sealing-wax,
And cabbages and kings,
And why the sea is boiling-hot,
And whether pigs have wings."

The walrus was versatile—so is "Hallyards." "Hallyards" has original opinions on scientific subjects—so had the walrus.

In KNOWLEDGE for July 3 Mr. Proctor somewhat earnestly disclaims some opinions, the honour and glory of which "H" had proposed to share with him. In KNOWLEDGE for July 17 "H" (in a postscript nearly a column long) appears to contend that Mr. Proctor must have held those opinions. One reason given is particularly rich:—"When a man writes a great deal, he cannot possibly remember all he writes." Then, if I cite "H." as an authority for the statement that "twice two are five," and if "H." repudiates it as something he could never have written, I have only to reply, triumphantly, "when a man writes a great deal" (which

[* The only mention of Hugh Miller's name that occurs in Dr. Geikie's book is on p. 277.—ED.]

"H." certainly does), "he cannot possibly remember all he writes." There is no fallacy in this of course. Oh, dear, no!

In KNOWLEDGE for July 10, a very complete reply (letter 1804) is given to "H.'s" bit of metaphysical mystification about "infinite divisibility." In the letter immediately following, the walrus —no, I beg his pardon, "Hallyards" (but they are inextricably mixed in my mind)—demolishes the law of gravitation on the very sufficient ground that a gas acts like a gas, and not like a solid. In KNOWLEDGE for July 17, "H." returns to the charge on the subject of infinite divisibility, but he persistently ignores the distinction between space and matter which was pointed out to him. An atom is indivisible not because it is too small to be divided, but because we have no means of dividing it. To this may be added that if we had the means of dividing the atoms of substance, say, oxygen, we should get *something*, but that something would not be oxygen. Let "H." get a heap of shot and a paper knife. He may divide the heap until he comes to single shots. These are (with the means he has) indivisible. But does it follow that the space each shot occupies is indivisible? "H." might find means to divide the shots further, either by smashing them with a sledge-hammer, or by putting them in an acid. The result in either case would not be shots, but *something else*. Talking of shot, I cannot help thinking that "Hallyards senior" brought down that 40 ft. condor by a weapon well-known to great travellers, and used by several who have given their names to parts of the earth's surface —the *long-bow*.

Don't be alarmed, Mr. Editor, I have no intention of following "H." through his whole range of subjects, "the comity of nations," "printers' devilry," blunders about quotations, solar myths, garden slugs, the man in the moon, &c. I would not if I could, and I am not a walrus. I propose to construct an index of all the subjects on which "H." has treated, and I have a strong suspicion that if ever completed it will be an example of the "infinitely divisible." A great deal of it surely belongs only to the "Paradox Corner."

W.

LAMMAS.

[1844]—"Mr. G. L. Gomme is satisfied that in the customs of Lammastide (1st of August) 'we have the key to the whole system of ancient agriculture.' The one great custom, he remarks, that links it with a very remote past, is the removal of fences from lands that were held in common by the village community, but which had to some extent been inclosed for individual proprietorship since the preceding Lammastide—a custom that prevailed with much curious variation on the South Downs in Sussex, besides other places, till within the last 50 years, even if it be *not* [?] yet extinct. His paper must be read as a whole in order to understand the force of his argument; the custom at any rate seems to have but weak connection with the reputed meaning of the word, which, like the other great mass days, involves a church offering, whether of a lamb, as sometimes explained, or of a loaf (*hlaf*)."—*Saturday Review* on "The Antiquary," vols. vi., vii. Oct. 27th, 1883.

Differing from the Reviewer above, I would suggest that the Lammas custom has the closest connection with the real—though not, indeed, with the reputed meaning of the word. Lammas in French is "St. Pierre-ès-liens." This word *lien* in English has come to have only a moral meaning, and to be pronounced (I think) like "lean." But when French was current in England, it was no doubt pronounced "*lyéan*," and used of material bonds. The mass would naturally be called "Lienmas"—or perhaps "Léanmas"—for *liane* in French means a *withe*—and then you have the word at once, without going to purely gratuitous hypotheses about lambs and loaves. The probability of this derivation would be greatly increased if it is the case that the feast was not known in England before the Norman Conquest; and this does seem probable. It is said in the lessons for the day in the Roman breviary that Eudacia, wife of Theodosius the younger, was presented at Jerusalem with the chain (*i.e.*, *one* of the chains) wherewith Herod bound St. Peter; which she sent to her daughter Eudoxia at Rome, who brought it to the Pope, and he then shewed her the chain wherewith St. Peter was bound by Nero; that the two joined themselves together so as to seem the work of one artificer; that thence a church was dedicated on the Exquiliæ under the name of St. Peter in Chains, and a feast assigned on the 1st August, till then occupied with surviving idolatrous festivities: the chains working miracles—*among which* in 969 a certain Count, a friend of the Emperor Otho, was delivered from a devil by contact with the chains: "*ac dienceps* in urbe sanctorum vinculorum religio propagata est." From which last concluding sentence I feel inclined to infer that the feast really dates from the end of the tenth century. It may not have been introduced into England till much later; Trinity Sunday was introduced only by St. Thomas Becket in memory of his own consecration on that day. If this be so, the feast would not be known to the pre-Norman English; and this would account for its not being called Bondmas, or any like name. The removal of the hurdles is, of course, a very graphic way of commemorating the falling of the chains from St. Peter's hands.

HALLYARDS.

MICHAELMAS.

[1845]—"Mr. Edward Peacock has a congenial subject in Michaelmas." [Does this mean that the great goose-feast must be interesting to all peacocks?] "Multitudes of angels, according to Jewish tradition, are created daily, but no archangels. These are limited to the original four who first spread their mighty wings at the birth of all things. The respect in which St. Michael is held, beginning with Satan himself, extending to Mahommed, coming down to John Bunyan, and continuing to now, is owing to his character as protector of the people of God. The Devil could not bring against him a railing accusation when the two disputed for the body of Moses." [This must allude to some little-known tradition; for St. Jude says, quite contrariwise, that *the Archangel did not dare* to bring, &c.] "The enemy of Michael is the enemy of God, according to the Prophet of Islam; and it is curious that so unsparing a bruiser of saint-worship and Popery as the man of Elstow should make his hero in his terrible fight with Apollyon call upon the prince of the archangels for aid; at least the winner in the conflict confesses to have done so with success in his after-pæan:—

> But blessed Michael helped me, and I
> By dint of sword did quickly make him fly—

that is, Apollyon."—*Saturday Review* on "The Antiquary," vols. vi., vii., Oct. 27, 1883.

The aid of St. Michael in Christian's conflict with Apollyon is just one of those anomalies which favour the theory that the earlier part of the P.P. was pirated by Bunyan, and is of pre-Reformation date. The Reviewer by the way errs in saying that Xn. either invoked St. M. or says he did so. He merely says that St. M. helped him. Any Protestant could say this: but the curious thing is that in the account of the conflict there is no mention of St. M.; and that in the last lines of the little hymn Xn. thanks "him"—"his holy name"—(*sic* in 1st Edn.)—there having been *no mention* of God whatever. Later editions have capital H's; exactly as in Exodus, where it is said "he" (Moses) wrote on the tables—which in our bibles is printed "He" to make it agree with the other account in Deuteronomy. If Bunyan had *meant* God, what reason can be assigned for his not having written it?

HALLYARDS.

THOUGHT-READING.

[1846]—Since writing the letter, 1769, in which I alluded to the theory that possibly a rudimentary sense or organ in some minds or brains might account for the phenomena of thought-reading and mesmerism, I have carefully applied the theory to each case of thought-reading recorded in KNOWLEDGE, Vol. VI. pp. 364, *et seq.*, with this result.

The first set of experiments refers to the guessing of the names of persons and things, and there appears no difficulty until we get to *cork*, which is guessed as *fork*. The only explanation I can see is that the questioner instead of having the idea fork in his mind had that of the word "fork" written or printed, or of the sound of the letters f, o, r, k; but then the experiment *tongs*, guessed as *fire-irons*, *poker*, wants exactly an opposite explanation. I will now refer to the experiments carried on at Liverpool by Messrs. Guthrie & Birchall. A gold cross is guessed first as something yellow, then as a cross. In this case one would like to know whether the questioner arrived at the idea by this process of reasoning, or whether he was looking at a gold cross. The next answer is remarkable—"Looks like an egg." It seems, therefore, that the thought-reader sees the things he is thinking of; for, again, in the next experiment, "a penholder with a thimble inserted on the end of it" is guessed as "a column with something bell-shaped turned down on it." It seems to me that much depends on the idea as conceived by the questioner. Supposing the questioner to be looking at a golden cross, one can imagine the image of a yellow cross appearing in the thought-reader's brain; but it seems to me that, if the questioner were merely thinking of a golden cross, the idea of gold *et hoc genus omne* rather than yellow would be produced in the thought-reader's brain. In a former letter I stated that whether we see a cannon fired, hear the report, or smell the powder, the same idea may be produced in our brains, namely, a cannon has been fired; but, as I am personally constituted, the idea "a cannon has been fired" neither pictures to my brain the smoke coming out of the muzzle, nor produces in my ears the sound of artillery, or in my nose the smell of sulphuretted

hydrogen, but rather makes me conscious of the idea in the abstract It may be said that there is no such thing as an abstract idea, and that we cannot think of virtue, but must conceive some particular act of virtue. Even if this be the case, we do not, I think, picture that particular act being performed by a particular person; nevertheless, in every case of thought-reading recorded, the thought-reader apparently pictures to himself something. He seems to be seeing something. He says: "A little tiny thing with a ring at one end and a little flag at the other, like a toy flag. It is very like a key." All the experiments recorded in the article seem to show that this, at any rate, was the idea of the writer, and that the experiments were selected accordingly. One would like to know what the experiments were which were considered unworthy of record.* It would be most unscientific to suppose that, if this rudimentary sense exists, only a very few possess it. If it exists in a few to such a marked degree as thought-reading experiments appear to prove, ordinary individuals must possess it in a less marked degree. Any one who has played the old game of "letters"—I mean the game in which one person forms a word, shuffles up the letters and gives them to another person to guess, knows how difficult it is to find out a word unless he sees it at once. In fact, my personal experience is, that I can guess the word before I have properly seen all the letters, or I must find it out mechanically by arranging the letters according to their most probable combinations. I used to think that I saw the letters *en masse* before I had time to notice any particular arrangement, and that they arranged themselves unconsciously into the word, but that when I noticed a particular arrangement of some of the letters as they lay, it suggested a particular word containing that arrangement. Still the arranging themselves unconsciously in my brain was still unexplained. But supposing the person giving the word was thinking of it at the moment it was given, and thought-transference possible, what otherwise is inexplicable is explained. Nevertheless, I am willing to admit that the arrangement and re-arrangement of letters does go on in my brain unconsciously. For instance, frequently when asked a person's name, all I can remember is the first letter, the number of syllables, and some, if not all, of the letters, but wrongly arranged. Curiously, in some of the answers given by the thought-readers, some such confusion is produced. For example, the questioner thinks of the name "Albert Snelgrove," but the answers given are "Albert Singrove" and "Albert Grover." Here the cause must be different, for in my case I am trying to recall something I have forgotten, but the thought-reader is trying to find something out. It seems to me clear that no progress can be made in the elucidation of thought-reading phenomena until it is clearly understood how ideas arise in the ordinary brain. In my own case, if I wish to fix an idea instead of picturing the thought, I seem to inaudibly repeat words which convey the idea, but this is not until after I have got the idea. So I suspect the thought-reader in many cases does the picturing after having taken in the idea, and works out the picture from the idea and not the idea from the picture. I cannot myself help thinking that when a compound idea becomes a conscious thought immediately on conception, that the action is direct, and not preceded either consciously or unconsciously, by a series of simple ideas leading up to the compound idea. What I mean is this, I see 23, as written, and the idea *twenty-three* is immediately conceived in my mind. Possibly there was a time when I should have had to have thought it out in this manner, the 3 is in the units' place and the 2 is in the tens', therefore it is twenty-three. But another time I see 2,000,003. Before I can pronounce it two millions and three, I must count the number of figures. It is not that the eye cannot take in so much at once, for three cows are as easy to count without counting as the angles of a triangle, and ten cows no more difficult than those of an irregular decagon. (Of course, the case of the Irishman's spotted-pig, which would run about and would not be counted, is an exceptional one.) Now, this forming a complex idea at once must have a most important bearing on the subject of thought-reading. It is evident the thought-reader and *thought-readee* must both be of the same mental calibre to obtain accurate reciprocity of thought. For instance, a capital C would probably suggest cat to my little boy, but to me it might suggest 100. It seems to me, therefore, for the theory of brain communication to be possible that it is almost necessary that an idea which is communicated should be a simple one. The theory apparently is that a certain particle, A, in a certain brain, B, has a certain motion, which produces a certain idea, C; that this motion produces an ether wave which sets in motion a particle, A′, in a brain, B′, which causes an idea, C′, similar to idea, C; that A B and C stand in the same relation to one another as A′ B′ and C′. The main difficulty seems to be this, supposing two or three persons present during an experiment, the brain of each must be sending off ether waves at the same time, and how does the thought-reader select the right one? Yet possibly this is the explanation of thought-reading. Thought-reading is not a particular or peculiar power of reading thought, but the power of concentrating the attention on one particular brain. Just as some persons can concentrate their attention on one person and listen to him in a crowd of talkers, when others only hear a buzz and cannot follow a single conversation. Another difficulty is the improbability of two brains being so similarly constituted that molecular motion in one should produce similar molecular motion in another. I see colours different shades with my right eye to what I do with my left. Mr. Proctor somewhere states that one of his eyes is short-sighted and the other long-sighted. In these cases the same exciting cause produces different ideas in the same person. Nevertheless, an inarticulate cry for help will set twenty persons running to the same spot, each having a very similar idea to his neighbour, or, at any rate, an idea quite as similar as the theory of direct brain communication seems to require. Whether physiologically the fact of a certain molecular motion producing a certain idea will ever be demonstrated or not, it is pretty certain that for every thought there is a corresponding molecular motion in the brain.

How calculating boys work out sums unconsciously, which mathematicians require pencil and paper for, seems more easily explained by a theory of thought-reading than in any other way, as the gift is lost as the intellect grows.* How we are able to follow the argument of a lecturer on a difficult subject by means of our ears alone (in some of us very imperfect organs) I do not know, unless our brains get into accord in some way; for frequently I have known the meaning of what a lecturer has said, and yet when I have tried to catch his exact words have found I could not distinguish them. On the other hand, I have frequently read a sentence over and over again without getting any meaning out of it.

Any one playing with young chess-players must have noticed how often, after waiting ten minutes or so for his adversary's move, which eventually is the wrong one (say leaving a piece *en prise*), that the young player, just as the hand is stretched out to take the piece without ever having touched the men, shouts out, "Wait a minute, please, I see a better move," and immediately puts the piece out of danger. Of course, some one may say it is no more wonderful than seeing a revoke the moment you have exposed the card—a most unfortunate trick of young whist-players—but here again, I say, it is some one else sees the revoke first. I really believe, if thought-transference is admitted, it will explain many circumstances which are now either called coincidences, or explained by a sharpness of sight and acuteness of hearing combined with a quickness of intellect and sensitiveness of touch more wonderful even than the disintegration theory of Madame Blavatsky and the Cashmere pundits. JOS. W. ALEXANDER.

[* I am entirely in accord with Mr. Alexander here. The aphorism of Lord Bacon, that men are more apt to mark when they hit than when they miss, is singularly pertinent to such investigations as those on which our correspondent is commenting.—ED.]

LETTERS RECEIVED AND SHORT ANSWERS.

H. D.—I should have fancied myself that the force with which any fluid, such as air, acted perpendicularly upon a plane obliquely opposed to it, varied as $\sin^2$ of the inclination of the plane to the direction of the current. Try this formula. I cannot at this moment refer you to any book in which the matter you are interested in is specially treated of. Moreover, I know of no work following on the lines of Barlow's "Mathematical Dictionary" which has since been published. No recent edition of it exists. — MASON. The Pyramids are chiefly built of the natural nummulitic limestone obtained either from the mountains near Cairo, or from quarries on the west side of the Nile; but also of granite, &c. The stones employed in its construction are of all sizes, some of the granite slabs being 17 ft. long by 3 ft. 9½ in. wide. As the Pyramids are built in a series of gradually diminishing platforms, it is probable that the stones were raised by a system of levers. Moreover, Herodotus tells us that the Great Pyramid occupied twenty years in erection, and that 100,000 men were employed in its construction. Human life was, of course, as cheap as dirt, and a Pharaoh would think as little of killing fifty men in raising a huge mass of stone by manual labour as he would of destroying the same number of flies.—LEONARD MORGAN BROWN.

[* I think it was De Morgan who suggested that this occult power of calculation rather pointed to some hitherto undiscovered property of numbers; perhaps akin to logarithms.—ED.]

Your letter is obviously intended for the Conductor of KNOWLEDGE, who is at present absent from England; whither, however, he will return in the course of a fortnight or so. I greatly fear that it will be as much out of his power to grant you a private interview as it is out of mine. The time of an editor is occupied in a fashion of which the outside world has not the most distant idea. Those who picture him as sitting in an easy chair with an old Cabaña in his mouth, only waiting for the pleasure of half-an-hour's chat with a visitor or correspondent, indulge in a veritable Almaschar's dream.—HUNDREDWEIGHT. The change of declination in the sun in January is not particularly rapid, notably at the beginning of the month. Still this *may* have produced a portion of the discrepancy. See Chauvenet's "Spherical and Practical Astronomy," Vol. I., p. 244. I should, though, myself be disposed to attribute the major part of it to irradiation, incident on the small power of the telescope and the eye-shade not being dark enough. Many of the shades furnished with sextants are far too light-coloured.—JAMES U. ROBERTSON. Do you seriously suppose that under the scarcely veiled pretext of describing a manufacturing process I am going gratuitously to advertise that you have shares of a company for sale? —H. F. YOUNG. If you wish to form a correspondence class, you must advertise in Mr. L.'s form. It is absolutely out of the question that such a class should be formed in connection with KNOWLEDGE itself. You might just as well ask me to lay in a stock of the various articles advertised in these columns, for retailing among its subscribers.—G. DUNCAN. Kindly read the paragragh in capital letters, which concludes those heading the correspondence columns. The conductor has nothing to add to his printed testimonial, which you must consult and draw your own inference from.—DR. LEWINS desires to put on record (for the *n*th time) that "all Hylo-Idealism requires is the categoric belief that the body is the real man—that this body is part of, not apart from, the circumambient universe, known to us only by sensation and thought, which are not external entities, but strictly functions, *i.e.*, creations of the same organism itself." He further wishes to direct the attention of readers to the article "Animism" in the 9th edition of the "Encyclopædia Britannica," to the volume on "Cause and Effect" by Dr. Thomas Brown, and to Mr. Fraser's article "On Ghosts" in the *Contemporary* for July.—HON. EXAM. '85. I have stated over and over again here, that I am not a crammer or coach, and that I must absolutely decline to do sums or solve equations or problems set in any examination whatever.—ALFRED GORSTON. It could only be accepted as a voluntary contribution.—CAPT. F. DE RICHELIEU. Much too long, and not of sufficient popular interest for insertion.—E. W. J. The papers on the "Morality of Happiness" have not as yet been reprinted. Whether they will form part of a future volume of the "Knowledge Library Series" has yet to be discussed and decided on.—T. H. GARFIT. Thanks, no. The subject is outside of those to which this journal is devoted. Undoubtedly, a Platyscopic lens is much more useful as a *microscope* than a common shilling hand lens.—THE GHOST OF JOSHUA. Any man who says that the sun at the North Cape at this (or any other) season remains virtually over the same point of the horizon for twenty-four hours, merely altering its altitude above it, lies—under some astonishing mistake.—A. BROTHERS. Conductor still in America. When your spectral image is projected on a distant background of course it looks monstrously bigger, as its angular dimensions remain invariable. If you could remove a little bush on to the horizon, preserving its angular subtense at the eye, it would look like a huge forest. *Vice-versâ*, any object brought from a distance, if it were possible, without the enlargement of the angle under which it is viewed would appear less.—ECLIPSED. The origin of the symbols of the zodiacal signs —as also in fact that of the signs themselves—is obscure. Some of them are tolerably apparent, *e.g.*, ♈ the ram's horns; ♉ the bull's head, and so on. The ♍ concerning which you are exercised, stands for Maria Virgo—the Virgin Mary. ♈ is formed by joining the two letters *τρ*; the beginning of the Greek word *τραγος*, a goat. ☿ is the caduceus of Mercury, ♀ the looking-glass of Venus, ♂ the shield and spear of Mars, ♃ the arm of Jove holding the thunderbolt, ♄ the scythe of Chronos or Saturn, &c.—JOSEPH KIRK. However much the ingenuity of your argument would entitle it to admission, it is perforce excluded by its essentially theological character. Of course you turn professedly literal history into pure allegory—but that is a detail.—R, A, H. I expect that the Conductor will be in England on or about the 8th prox., when your proposal shall be submitted to him.—A. KOROBOFF. The Roman Catholic sect and that of the Greek Church may be all that you aver; but it is utterly out of the question that I should reproduce your appeal to M. Jules Ferry here, or afford space for your claim to be the regenerator of the world.—S. FLOOD PAGE. The Directors' Reports of Commercial Companies can find no place in these columns.—WM. MCKENZIE. Needlessly detained through being addressed to the *Editor* instead of the publishers.

Our Inventors' Column.

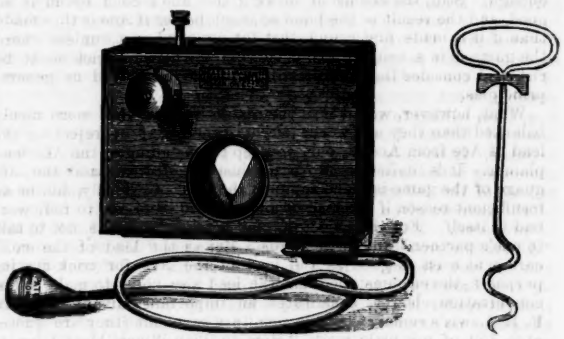
PHOTOGRAPHIC SHUTTER.

[Patent No. 7,792. 1884.]—In exposing sensitive plates for instantaneous photographs it has always been a desideratum to obtain a comparatively longer exposure for the foreground than for the distance.

This result is obtainable by use of this shutter, patented by Mr. Heath and manufactured by Messrs. Marion & Co., in the following manner:—Two plates are cut obliquely and made to pass over one another, in opposite directions, by a parallel motion, the result being that in their transit the bases of the apertures exposing the lower portion of the lens are the first to be uncovered and the last to be closed, thus very greatly increasing the proportionate exposure of that portion of it.

The movement is communicated to the plates from a coiled steel spring, by means of arms with slots, traversing and driving pins in the same.

A break is attached by which speed can be reduced from an instantaneous exposure to one of two or three seconds. The spring working the plates is released by the depression of a small stud shown on the bottom of the frame. This is accomplished by urging forward a small piston in the cylinder adjacent to the stud. The pneumatic device patented by Cadet is employed for this purpose.



Photographic Shutter. Rick-cover Fastener

FASTENING RICK-COVERS.

[Patent No. 9,040. 1884.]—H. G. Norrington, of Bonhay-road, Exeter, has patented a simple but effective fastener for fixing galvanised corrugated iron sheets, now generally coming into use, to both hay- and corn-ricks. It is applied by punching a hole on the top of a corrugation in the sheet, inserting the end of the fastener, and screwing it in, when it draws itself into the rick, until the grooved washer firmly fixes down the sheet, the groove at the same time fitting the corrugation so as to prevent any rain entering the hole made. There are many advantages apparent to agriculturists in being able at any time to permanently cover their ricks without having to wait for a thatcher. Curved sheets can be used for the ridges, and ventilation, if necessary, can be secured by leaving the space between the hay and the ridge.

SLIDING-SEAT FOR RACING BOATS.

[Patent No. 11,829. 1884.]—This invention, by Mr. J. C. Green, of 21, Great Southsea-street, Portsmouth, is fitted with rollers, the application of which causes the seat to work with less friction than exists in the ordinary sliding-seat. The rollers are placed so that the seat runs true, and they are so fitted that if the boat happens to be off her level keel, the working of the seat is not affected. The difference claimed, therefore, in the working of the ordinary sliding-seat and the "Improved Sliding-Seat" is:—That the amount of force, which is required to overcome friction in the former, is with the improved seat made available for materially increasing the speed of the boat. With this invention, therefore, a speed can be attained which it is impossible to produce by the use of the ordinary sliding-seat. The latter bears directly upon the slide-rods without any medium, whilst the "Improved" seat has rollers fitted between the wooden seat and slide-rods, which cause the seat to run easier than the ordinary sliding-seat.

Our Whist Column.

BY "FIVE OF CLUBS."

WHEN *NOT* TO LEAD ACE.

I HAVE shown why the accepted leads of the Ace from length are sound. These leads are two only, viz., from Ace four others, not including the King; and from Ace, Queen, Knave, with or without others. But Continental players usually lead Ace from Ace three others, and among Americans especially in the West one too often notices the unsound lead of Ace from Ace, King, and others,—though, I need scarcely say, one does not observe this among American players of the game of Whist, properly so-called. (Unfortunately players of this class are few, in America.)

With regard to the lead of Ace from Ace three others, we may admit that it is sound enough in itself. I prefer the lead of lowest from such a suit even on general principles, but I cannot deny that there is much to be said in favour of the Ace lead. It is usually a safe lead, like the French opening at Chess. The Ace is almost certain to be made; and by leading out another round immediately, the suit is generally too well cleared for the weakness of the leader to cause serious mischief. It may happen, of course, that one of the enemy have length in the suit, and that giving up the command means throwing several tricks into the opponents' hands. But usually the lead of the Ace from Ace three others turns out well enough. Still, the chance of making the Ace second round is so good, and the result to the hand so much better if Ace is thus made than if it is made first round, that for my own part, unless where the game is in a critical state, so that no certain trick must be risked, I consider the small card the best to be played on general principles.

What, however, would turn the scales if they were more nicely balanced than they are, is the circumstance that by rejecting the lead of Ace from Ace to four, we keep the meaning of the Ace lead plainer. It is limited to two cases, instead of three, and the language of the game is made so much the clearer. This would be an insufficient reason if the lead of a small card from Ace to four were bad in itself. For the object of play is to make tricks, not to talk to one's partner through the cards. But as the lead of the small card is at least as good as the lead of the Ace for trick-making purposes, the circumstance that the lead also helps to make Whist conversation clearer, constitutes an important advantage. Mr. F. H. Lewis's remarks on this point are excellent (they are quoted at p. 159 of my little work "How to Play Whist"):—"I am in favour," he says, "of leading a small card from Ace to four originally, and also in the course of the hand, unless in the latter case, the play of the previous suits has shown an irregular division of the cards, in which event the Ace might be in danger: I am in favour of thus leading a small card, because I am in favour of uniformity at Whist: I lay no stress whatever upon the argument that uniformity gives information to the adversaries as well as to partner."

About the other case in which Ace is led wrongly, there can be no question. There is no division on this point between the players in England, those on the Continent, and those in America; yet there is no error about which bad players are so positive and persistent, as about this lead,—viz. of Ace, from Ace, King, and others. Of course every Whist player leads the King in such cases; and from Hoyle's time to the present there has never been any division of opinion. Yet, those who lead the Ace are full of arguments (or what they regard as such) in favour of their way of leading.

The learner's chief difficulty on this point is to know how it can matter whether the Ace or King is led: to which, when they are a little more advanced, they add that as the highest of a head sequence is usually led, the lead of King seems an unnecessary exception. To these negative objections it is a sufficient answer to say that there are already two accepted leads of Ace, and there is but one other case (besides Ace, King, and others) from which King can *possibly* be an original lead,—viz. from King, Queen, and others; so that if it is a matter of indifference whether Ace or King is led, so far as trick-making is concerned, it is obviously best to lead the King so as to distinguish this lead from the two cases in which Ace is led originally. As against this advantage, the exceptional nature of the lead of the lower card of a head sequence is as nothing,—rather it serves to emphasize the significance of the King lead.

But positive objections are urged by those who are not students of Whist, indeed regard themselves as better able to teach than to learn, against the lead of the King. For say they, the King may be trumped by your partner, unaware that you hold the Ace also; whereas if you lead the Ace, of course he passes the trick. This particular objection, which I have heard now about a hundred times, affords a good measure of the quality of bumble-puppy players. It assumes, practically, that either you would lead a singleton King, or that having King and others (not including Queen) you would lead the King for the sake of giving your partner a ruff,—this, too, as an original lead. One lead or the other it must be to justify their reasoning; for the lead of King from King Queen which has been uniform with Whist players since Hoyle's time, these folks utterly reject. Now if I had a partner whom I knew to be so bad a player that he would lead King single, or King from King and others not in sequence with it, for the sake of getting or giving a ruff (except where a single trick would save or win the game), I might ruff his King without remorse, knowing that nothing could spoil *his* play, and that that *might* be what he wanted. But to ruff a King led by partner (unless in a case presently to be considered) would be such atrociously bad play, that no one but a bummble-puppist could imagine so gross an offence against Whist principles. If I *knew* fourth player held the Ace (say through his having exposed the card early in the game) I should play atrociously were I to ruff my partner's King,—seeing that his only conceivable object in leading it under ordinary conditions would be that he might draw the Ace and obtain command of his suit.

This particular objection only avails then to show how little the bumble-puppist appreciates the principles of the game. He has no idea of the importance of obtaining or retaining the command of suits, whether as a measure of offence or of defence. His only idea is to capture a trick when he sees the chance, even though he may ruin his partner's strategy and lose three or four tricks by so doing.

The chief direct advantage of the King lead, from Ace, King, and others, is that should you see fit from the fall of the cards to discontinue the suit, your partner knows almost certainly that you have the Ace left, whereas if you lead the Ace and then stop he would not know that you have the King.

In one case only should you lead Ace from Ace, King, and others:—If you have trumped one suit, and led King, your partner might think you saw an opportunity of establishing a cross ruff or of at least getting another ruff in the suit you had trumped, and therefore would be apt to trump your King, if he had none of the suit. To avoid this, it is best in such a case to lead Ace first and then King.

SINCE 1810 the Municipality of Aberdeen has spent £1,033,000 on harbour works. In 1811 the revenue amounted to £1,214; in 1835, it was £13,635; in 1860 it had risen to £27,443; and in 1884 it reached £58,293.

A TEMPERATURE of 570° will produce a dark blue colour on polished steel, and 590° a pale blue. Oil or grease of any kind will answer for drawing the temper of cutlery. The temper for lancets is obtained at 430° Fahr., axes at 500°, swords and watch-springs at 530°, small saws at 570°, and large saws at 590°.

SPECIFIC GRAVITY OF AMERICAN WOODS.—Of the four hundred and thirteen species of trees found in the United States, there are sixteen species whose perfectly dry wood will sink in water. The heaviest of these is the black ironwood (*Condalia ferrea*) of Southern Florida, which is more than thirty per cent. heavier than water. Of the others, the best known are the lignum-vitæ (*Guaiacum sanctum*) and mangrove (*Rhiziphora mangle*). Another is a small oak (*Quercus grisea*), found in the mountains of Western Texas, Southern New Mexico, and Arizona, and westward to the Colorado desert, at an elevation of five thousand to ten thousand feet. All the species in which the wood is heavier than water belong to semi-tropical Florida or the arid interior Pacific region.

NEW GUTTA-PERCHA TREE.—Instigated by the threatened dearth of the gutta-percha tree (*Isonandra Gutta*), M. Heckel has sought a substitute, and claims to have found it in the *Birtyrospermum Parkii* (Kotschy) of equatorial Africa, and abundant in latitudes between Upper Senegal and the Nile, especially in the forests of the Niger and Nile regions. It affects the argillaceous and ferruginous soils of Bambarras Boure and Fonta-Djalon, where the Africans gather its fruit, which yields a grease called *karite*. The juice or milk is obtained by incision from the bark, and on evaporation resembles gutta-percha. M. Heckel states that he has sent seeds to various French colonies, and also to England, in the hope that the latter country will try the experiment of introducing the tree into her vast tropical possessions. M. Heckel also calls the attention of English botanists and chemists to the divers Indian *Bassias*, as he is led by analogy to infer that they might furnish milky products similar to the Bassia Parkii.

Our Chess Column.

By MEPHISTO.

INTERNATIONAL CHESS TOURNAMENT OF THE GERMAN CHESS ASSOCIATION.

Hamburg, July 25.

THIS tournament, which was played at Hamburg, attracted most of the best players of England and the Continent, as well as Captain Mackenzie from New York. The playing strength in this tournament, as may be seen from the list published below, was very considerable, and the number of competitors, eighteen, made the test severe. In addition to the well-known names of the English and Continental Chess celebrities, there appeared several German players, hitherto unknown to fame. Nonetheless, some of these players showed real first-rate capacity. One of them, Dr. Tarrasch, of Halle, quite a young man, at one time even looked like as if he would easily carry off the first prize, he having defeated Mason, who for the greater part of the tournament played exceedingly well, and was considered first favourite. The contest proved a very close affair indeed, so much so that on the very last day no less than five players had chances for the first prize, viz., Gunsberg, 11; Weiss, 11; Englisch, 11; Mason, 9½ (with two adjourned games); nd Dr. Tarrasch, 11½. It was an exciting finish. Blackburne, by defeating Dr. Tarrasch disposed of his chance for first prize. Englisch could do no more than draw with Berger, and Weiss likewise scored only a half against Mason. Gunsberg was the only one of the ve who vanquished his opponent Gottschall, his score being raised hereby to 12 against 11½ of Blackburne, Tarrasch, Weiss, and Englisch. Even then Mason, with 10, could have tied with him. The adjourned game, Mason v. Minkwitz, therefore attracted great attention. With great coolness, Mason played what seemed to be a hopeless ending in masterly manner. At one moment even it seemed as if his efforts would be crowned with success. Minkwitz, however, effected a draw. This left Gunsberg first prize-winner, with 12, against five such formidable and closely-pressing rivals as Blackburne, Mason, Englisch, Tarrasch, and Weiss, who each scored 11½, and divided from second to sixth prize. Next came Mackenzie, seventh with 10, and Riemann and Schallopp, both good players, with 9½. Gunsberg, in the first half of the tournament, scored 5 out of 9, and was little thought of as first prize-winner. Of the remaining 8 games, however, he won no less than 7, defeating amongst others Blackburne, Mackenzie, and Bird, thereby attaining his unexpected success. Below we give a game played by the first prize-winner.

Complete score list of the Tournament:—

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	Score.
Berger (A)	—	½	½	½	½	½	1	½	½	½	½	½	½	0	½	½	0	½	8
Bier (B)	½	—	0	1	0	0	0	0	0	0	1	1	0	0	½	0	0	0	3½
Bird (C)	½	1	—	0	0	0	0	0	0	1	1	1	1	½	1	0	1	0	8
Blackburne (D)	½	0	1	—	1	1	0	1	0	1	1	½	1	0	1	1	1	½	11½
Englisch (E)	½	1	1	0	—	1	½	0	½	1	1	1	0	0	1	1	1	1	11½
v. Gottschall (F)	0	1	1	0	0	—	0	½	0	0	1	0	0	1	1	0	0	½	6½
Gunsberg (G)	½	1	1	1	½	1	—	1	0	1	0	1	0	1	1	1	1	½	12
Mackenzie (H)	½	1	1	0	1	½	0	—	0	1	1	½	½	0	½	1	0	½	10
Mason (I)	½	1	1	1	½	1	1	1	—	½	½	1	0	0	1	0	1	½	11½
Minckwitz (J)	½	1	0	0	0	1	1	0	0	½	—	½	1	1	½	1	0	0	9
Dr. Noa (K)	½	0	0	0	0	0	1	0	½	0	½	—	1	0	1	0	0	0	5
W. Baulsen (L)	½	½	0	½	0	1	0	½	0	½	0	0	—	0	0	½	0	0	4
Riemann (M)	½	1	0	0	1	1	1	½	1	0	0	1	—	1	½	0	½	½	9½
Schallopp (N)	1	1	½	1	1	0	0	1	0	1	0	1	0	—	1	0	1	0	9½
Schottländer (O)	½	½	0	0	0	0	0	½	0	½	0	½	1	0	—	0	½	½	4
Dr. Tarrasch (P)	½	1	1	0	0	1	0	1	1	0	1	1	½	1	1	—	1	1	11½
Taubenhaus (Q)	1	1	0	0	0	1	0	½	0	0	1	1	½	0	½	0	—	0	6½
Weiss (R)	½	1	1	½	C	½	½	1	½	1	1	1	½	1	½	0	1	—	11½

GAME PLAYED IN THE FIFTH ROUND ON JULY 15.

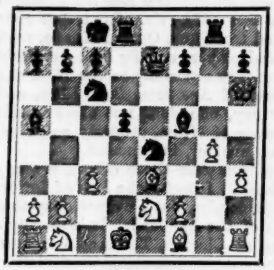
SCOTCH GAMBIT.

White. Schallopp.	Black. Gunsberg.	White. Schallopp.	Black. Gunsberg.
1. P to K4	P to K4	11. P × P	Kt × P
2. Kt to KB3	Kt to QB3	12. B to Q3	Q to R4
3. P to Q4	P × P	13. P to KKt4 (?)	Q to R6
4. Kt to P	B to B4	14. B to K4	Kt × B
5. B to K3	Q to B3	15. Q × Kt	B × P
6. P to QB3	Kt to K2	16. Q to Kt5	Kt × Kt
7. Q to Q2	Castles	17. P × Kt	B × P
8. B to Kt5 (?)	B to Kt3	18. R to KKt sq.	B × QP
9. Kt to R3	Q to Kt3	19. B to B5	Q × P
10. P to B3	P to Q4	Resigns	

Following, are two of the many pretty endings played in this Tournament:—

Position after White's 14th move in the game between Paulsen and Schallopp:—

SCHALLOPP.
BLACK.

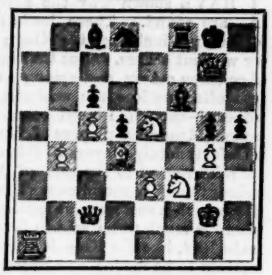


WHITE.
PAULSEN.

14.	P to Q5
15. P × P	Q to Kt5
16. P × B	Q to K8 (ch)
17. K to B2	Kt to Kt5 (ch)
18. K to Kt3	Q to Q sq. (ch)
19. K to R3	P to Kt4
20. P to Kt3	R to Kt3!
21. P × R	Kt to Q6
22. B to Q2	Q × B!
23. Q × Q	Kt × Q
Resigns	

Position after Black's 34th move in the game between Mac-Tarrasch:—

TARRASCH.
BLACK.



WHITE.
MACKENZIE.

35. Kt to Kt6	P × P
36. Kt (B3) to K5	B × Kt
37. B × B	Q to KB2
38. Kt to K7 (ch)!	Resigns

Mr. R. A. Proctor's Lecture Tour.

Subjects:

1. LIFE OF WORLDS
2. THE SUN
3. THE MOON
4. THE PLANETS
5. COMETS AND METEORS
6. THE STAR DEPTHS

Each Lecture is profusely illustrated.

Arrangements are now being made for the delivery of Lectures by Mr. Proctor from August onwards. Communications respecting terms and vacant dates should be addressed to the Manager of the Tour, Mr. JOHN STUART, Royal Concert Hall, St. Leonards-on-Sea.

Aug. 11, 12, Worthing; Aug. 13, 14, 18, Brighton; Aug. 20, 21, Eastbourne; Aug. 17, 19, 22, Tunbridge Wells; Aug. 25, 26, Folkestone; Aug. 27, 28, Matlock-Bath; Aug. 29, 31, Burton-on-Trent.

Sept. 1, Burton-on-Trent; Sept. 2, 8, 11, 15, York; Sept. 3, 4, Bridlington; Sept. 7, 9, 10, Scarborough; Sept. 14, 15, 21, 22, Harrogate; Sept. 17, 18, Whitby; Sept. 24, 25, Ilkley; Sept. 28, 29, Derby.

Oct. 31, Marlborough College.

Nov. 4, Burnley; Nov. 9, Stafford; Nov. 12, Middlesbrough; Nov. 17, Darwen.

Dec. 7, 8, 9, Croydon; Dec. 16, 17, 18, 19, Leamington.

Jan. 12, Hull.

Feb. 3, Alexandria; Feb. 10, Walsall; Feb. 18, 25, London Institution.

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